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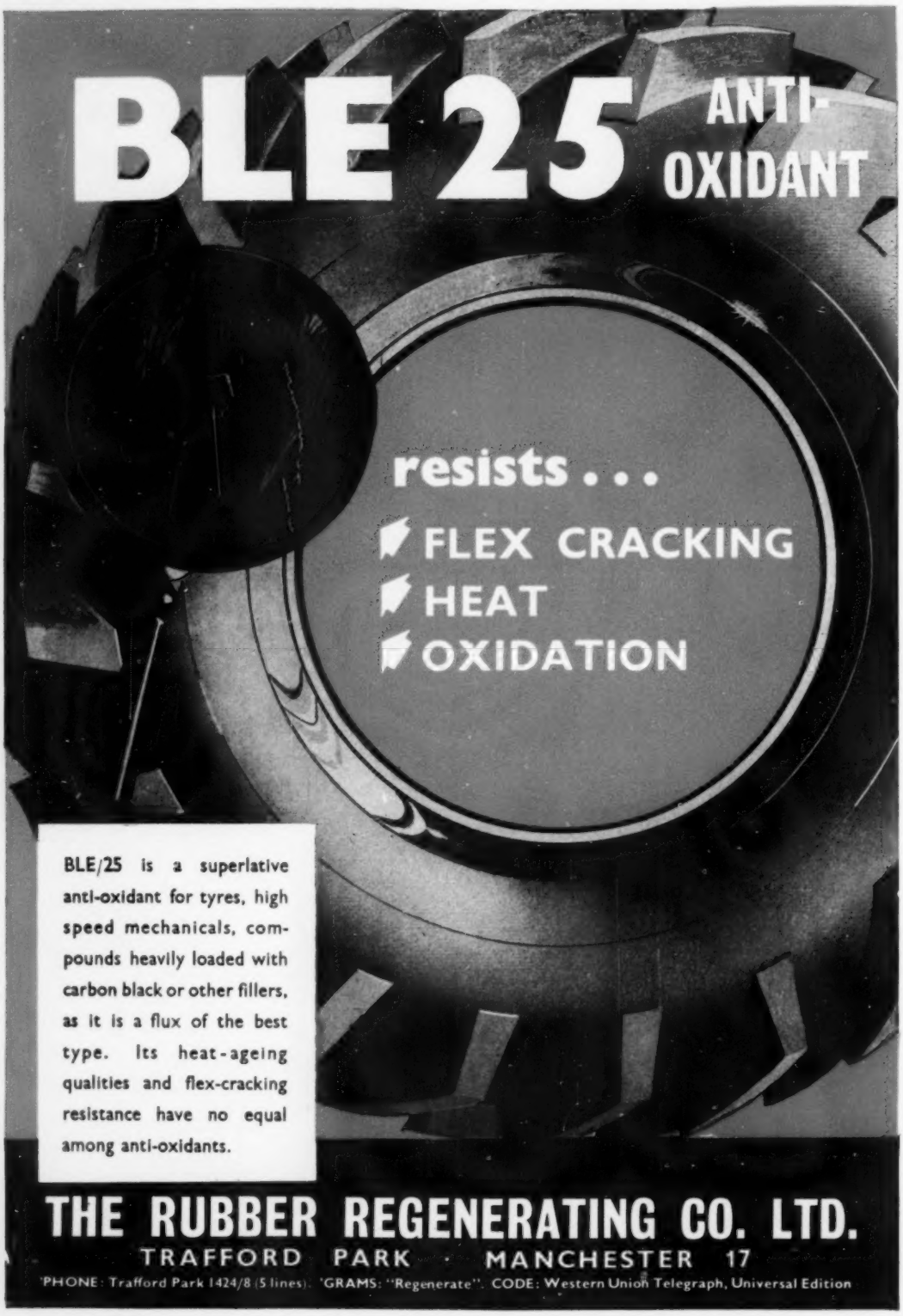
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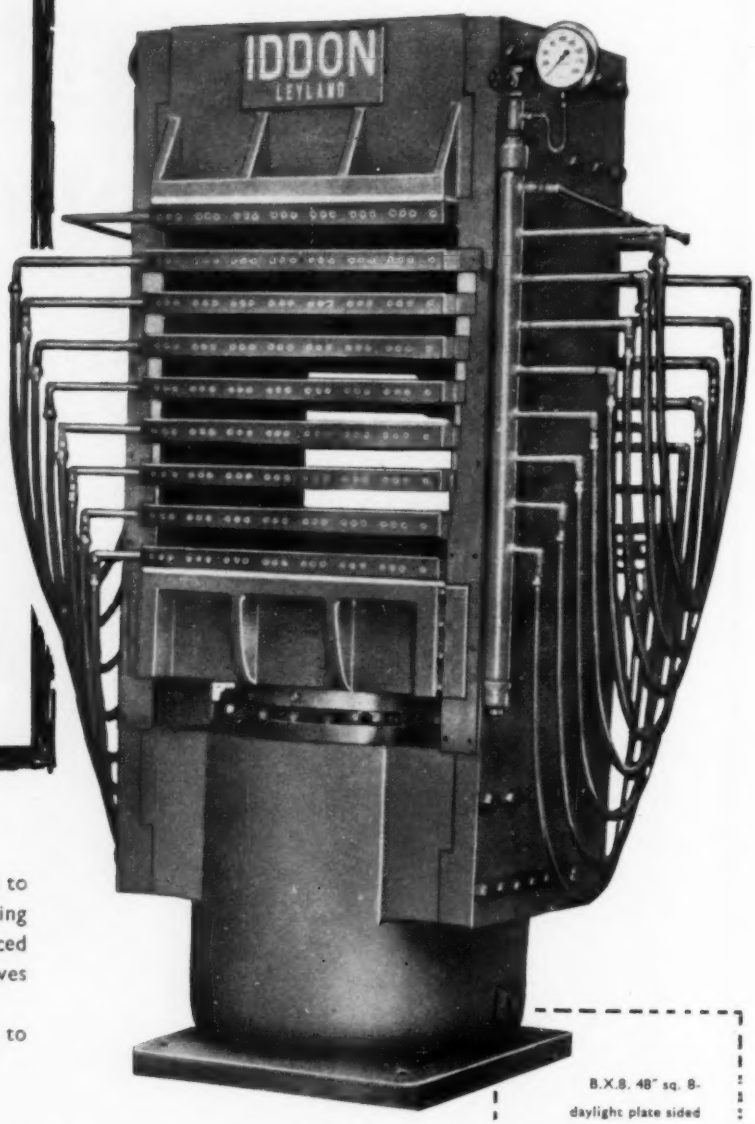

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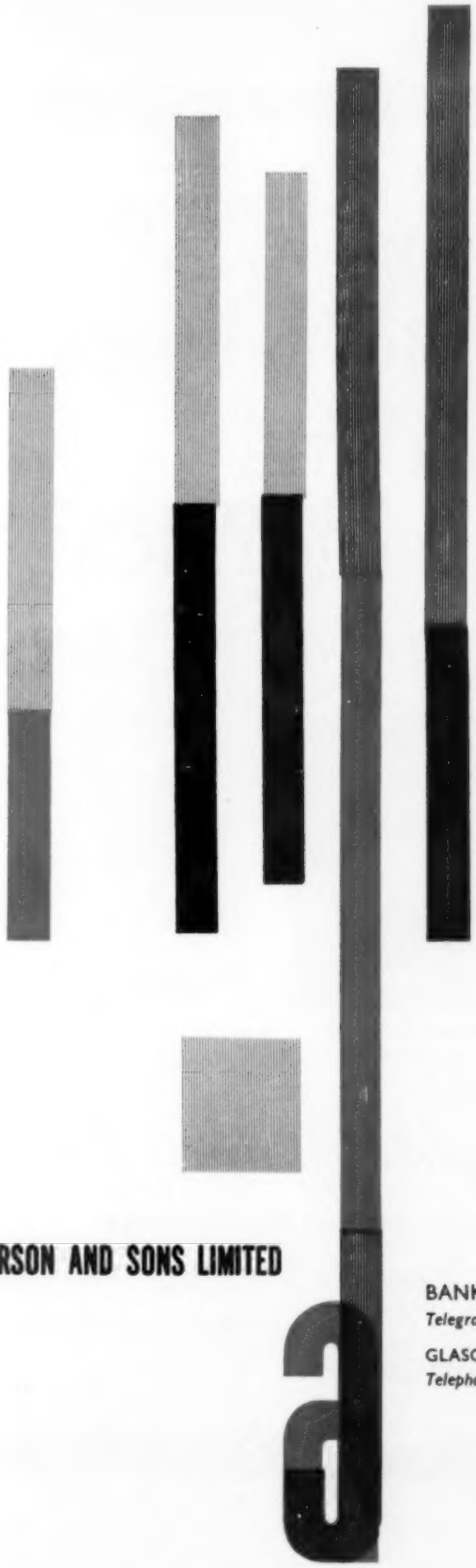

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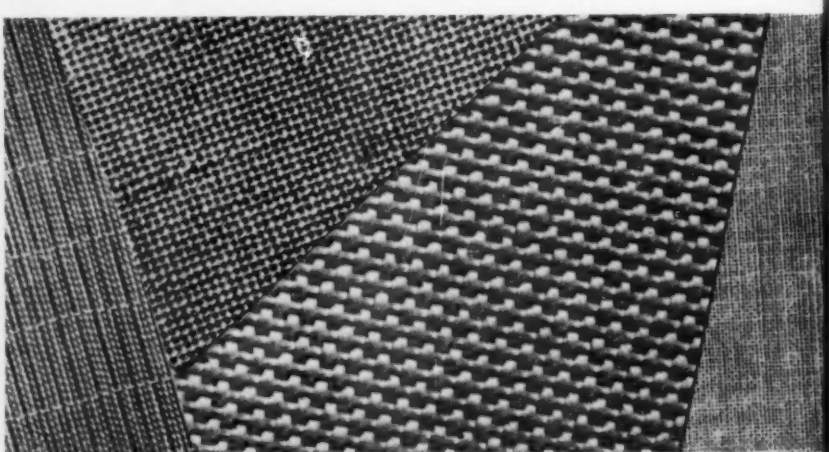

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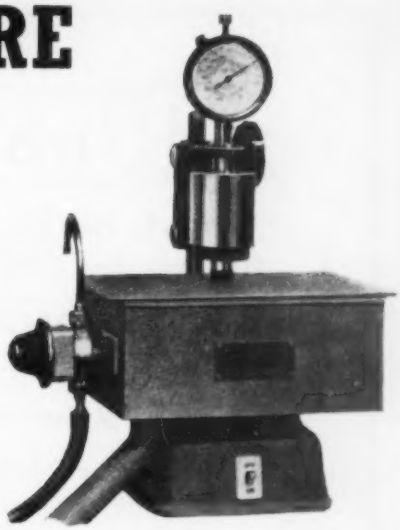

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IN ITS 76th YEAR

February 13 1960

Editorial

NOTES OF THE WEEK 229

Articles and News

NEWS BRIEFS 230
POLYTHENE—PART II 231
FACTICE IN NITRILE RUBBER COMPOUNDS 235
PREPLASTICIZING IN INJECTION MOULDING 240
SCIENCE MUSEUM DISPLAY 249
INSTITUTION OF THE RUBBER INDUSTRY 250
COMPOUNDING PROBLEMS 250
STEAM CURING OF RUBBERS 252

Features

VIEWS AND REVIEWS 245
MEN AND MATTERS 246
QUESTION CORNER 248
RUBBER STATISTICS 253
BOOK REVIEWS 253
PATENT SPECIFICATIONS 254
RUBBER AND PLASTICS STOCK MARKET 255
RUBBER MARKETS 256
INDUSTRY INTELLIGENCE 257
FUTURE EVENTS 258

Classified Advertisements . . . 259 Advertisers Index . . . 262

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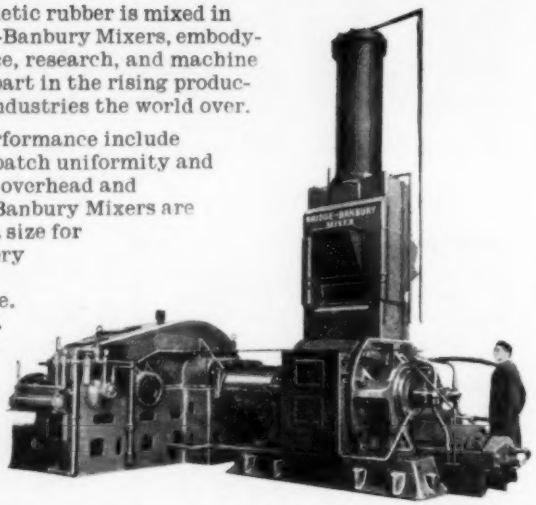

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NOTES of the WEEK

UK Plastics to USA

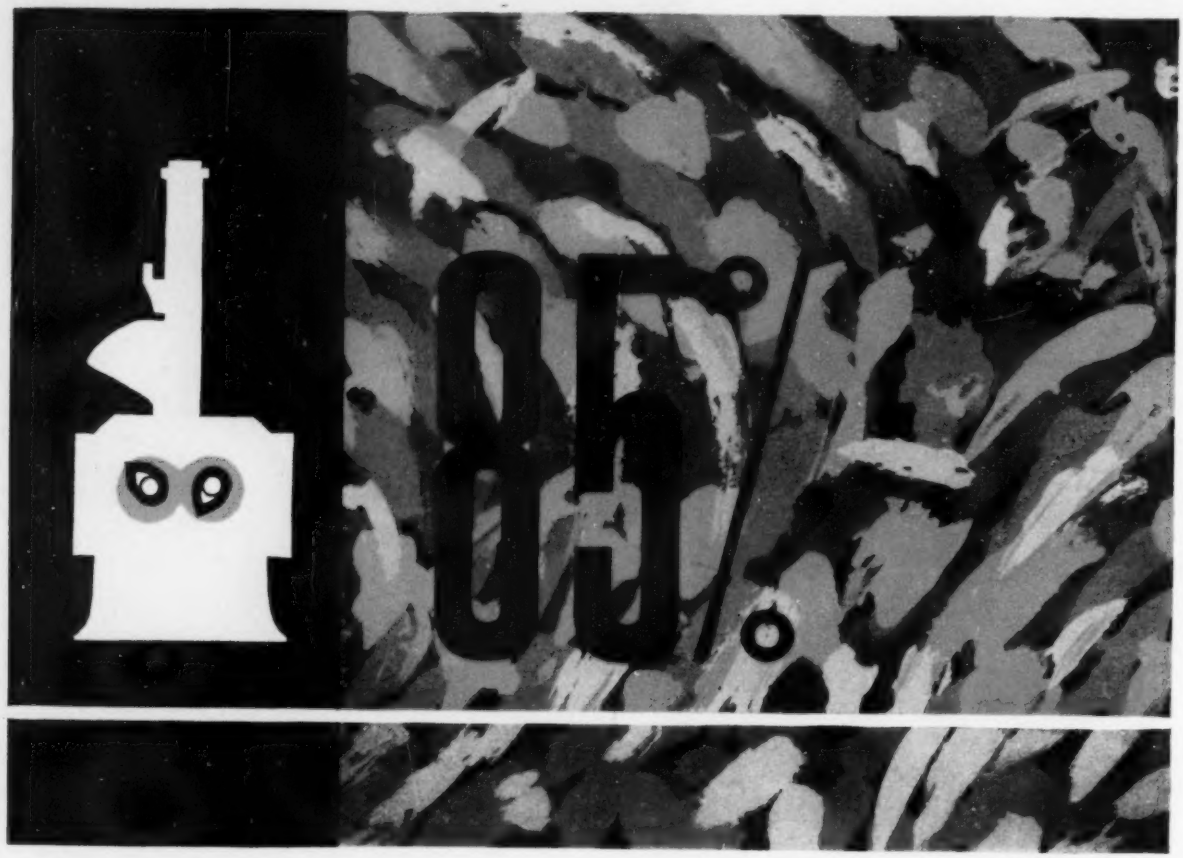
A WIDE and multi-million dollar market exists in the USA for British plastic materials of all descriptions. Imports are definitely on the increase each year. Truly significant increases can be realized if genuine attempts are made merely to solicit the huge American demand which already exists, despite the size of domestic industry. The presence of a domestic industry as often makes a market as it precludes one. This viewpoint, and there cannot be many who, upon reflection, would disagree with it, was put forward as his firm personal belief by Edwin L. Gitow in the third of a series of reports on some United Kingdom exports to the USA published in the *Board of Trade Journal*. Mr Gitow, who is vice-president of Strauss International Corporation, states that the principal problem of exporting plastics to the United States has been one of convincing British manufacturers that it could be done. Of his own experience, he says, starting in the third quarter of 1958, our firm began the serious development of the American market for decorated vinyl plastic film and sheeting. Thanks to a wide variety of unusual designs and superb craftsmanship available only in England, a ready market was found amongst manufacturers of consumer goods items such as small leather goods, fashion accessories, packaging—even diaper bags. In 1959, additional designs and new technical developments were introduced to the American market through the medium of a trade fair organized exclusively for British plastics. As a result, a small but growing permanent market has now been established for British vinyls in the United States. The term ' plastics,' of course, is not limited to vinyls. There is a large potential market in the United States for many other plastics produced in England. Usually there exists some variation, form, design or technique in the industry available in England, but unknown and, most importantly, unable to be duplicated in America, that will open doors here rather quickly. The British plastics industry is amongst the most advanced in the world . . . and so is the American plastics industry! This very situation has until recently discouraged the serious undertaking of exporting plastics to the United States. As Mr Gitow remarks, in one sense, this attitude has been most naïve. General trade statistics will show that one highly industrialized country is the best market for another highly industrialized country.

Rubber Research

WHAT might be described as a concentration of conferences is scheduled for next September with two in Kuala Lumpur and one in Singapore. The subject is, naturally, natural rubber. The Natural Rubber Research Conference, whose preliminary programme has already been reported in the Journal, takes place in Kuala Lumpur from September 26 to October 1. It will be the first time that a research conference of the importance and size envisaged has been held in KL, which has perhaps been chosen on account of Malaya's now almost certain position as leading producer of natural. It is sponsored by the Rubber Research Institute of Malaya and is to be in two sections: one on research on natural rubber production and the other on the chemistry of the product. Preceding this conference in KL will be the seven-day conference of the International Rubber Study Group. Production, uses and marketing problems will be among the subjects discussed by delegates from some 22 countries. The third conference on the list, the first chronologically, is to take place in Singapore. There, shippers and packers are to discuss standards, quality and packing methods among other subjects.

More Synthetic Rubber

NATURAL Rubber Bureau estimates for 1960 predict an increase in total consumption (excluding USSR and China) over 1959 of 135,000 tons to 3,735,000. It is interesting to note that the Bureau considers that all but 5,000 tons of this increase will be synthetic rubber. World production of synthetic rubber in 1959 (excluding USSR and China) is estimated to have been 1,600,000 tons, with consumption 80,000 tons less than this figure. USA production in 1960 will be, it is estimated, 1,400,000 or 30,000 tons up on 1959 synthetic production. The remainder of the predicted increase, 100,000 tons, will therefore be coming from plants outside USA (once again excluding USSR and China). In this country, the International Synthetic Rubber Company announced towards the end of last month that production was to be raised 20,000 to 90,000 tons annually, which figure is exactly the Bureau estimate for UK consumption of synthetic rubber. This does not mean, of course, that all synthetic consumed in the UK will come from ISR. The company already exports considerable quantities to all main rubber-consuming centres. It is likely that a proportion of the 15,000 tons by which the NRB estimates UK synthetic consumption will rise during 1960 will consist of more special purpose synthetic rubbers from dollar areas. Such an increase may also be expected following on the removal of restrictions on January 28 from four import categories, including synthetic rubber. It must, however, be remembered that USA imports are still subject to 10% duty. Those from Canada, on the other hand (notably from Polymer Corporation Ltd.), are duty free under Imperial Preference.



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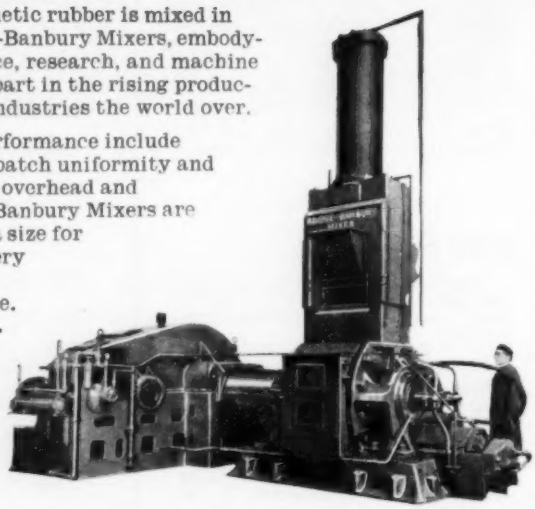

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A WIDE and multi-million dollar market exists in the USA for British plastic materials of all descriptions. Imports are definitely on the increase each year. Truly significant increases can be realized if genuine attempts are made merely to solicit the huge American demand which already exists, despite the size of domestic industry. The presence of a domestic industry as often makes a market as it precludes one. This viewpoint, and there cannot be many who, upon reflection, would disagree with it, was put forward as his firm personal belief by Edwin L. Gitow in the third of a series of reports on some United Kingdom exports to the USA published in the *Board of Trade Journal*. Mr Gitow, who is vice-president of Strauss International Corporation, states that the principal problem of exporting plastics to the United States has been one of convincing British manufacturers that it could be done. Of his own experience, he says, starting in the third quarter of 1958, our firm began the serious development of the American market for decorated vinyl plastic film and sheeting. Thanks to a wide variety of unusual designs and superb craftsmanship available only in England, a ready market was found amongst manufacturers of consumer goods items such as small leather goods, fashion accessories, packaging—even diaper bags. In 1959, additional designs and new technical developments were introduced to the American market through the medium of a trade fair organized exclusively for British plastics. As a result, a small but growing permanent market has now been established for British vinyls in the United States. The term ' plastics,' of course, is not limited to vinyls. There is a large potential market in the United States for many other plastics produced in England. Usually there exists some variation, form, design or technique in the industry available in England, but unknown and, most importantly, unable to be duplicated in America, that will open doors here rather quickly. The British plastics industry is amongst the most advanced in the world . . . and so is the American plastics industry! This very situation has until recently discouraged the serious undertaking of exporting plastics to the United States. As Mr Gitow remarks, in one sense, this attitude has been most naïve. General trade statistics will show that one highly industrialized country is the best market for another highly industrialized country.

Rubber Research

WHAT might be described as a concentration of conferences is scheduled for next September with two in Kuala Lumpur and one in Singapore. The subject is, naturally, natural rubber. The Natural Rubber Research Conference, whose preliminary programme has already been reported in the Journal, takes place in Kuala Lumpur from September 26 to October 1. It will be the first time that a research conference of the importance and size envisaged has been held in KL, which has perhaps been chosen on account of Malaya's now almost certain position as leading producer of natural. It is sponsored by the Rubber Research Institute of Malaya and is to be in two sections: one on research on natural rubber production and the other on the chemistry of the product. Preceding this conference in KL will be the seven-day conference of the International Rubber Study Group. Production, uses and marketing problems will be among the subjects discussed by delegates from some 22 countries. The third conference on the list, the first chronologically, is to take place in Singapore. There, shippers and packers are to discuss standards, quality and packing methods among other subjects.

More Synthetic Rubber

NATURAL Rubber Bureau estimates for 1960 predict an increase in total consumption (excluding USSR and China) over 1959 of 135,000 tons to 3,735,000. It is interesting to note that the Bureau considers that all but 5,000 tons of this increase will be synthetic rubber. World production of synthetic rubber in 1959 (excluding USSR and China) is estimated to have been 1,600,000 tons, with consumption 80,000 tons less than this figure. USA production in 1960 will be, it is estimated, 1,400,000 or 30,000 tons up on 1959 synthetic production. The remainder of the predicted increase, 100,000 tons, will therefore be coming from plants outside USA (once again excluding USSR and China). In this country, the International Synthetic Rubber Company announced towards the end of last month that production was to be raised 20,000 to 90,000 tons annually, which figure is exactly the Bureau estimate for UK consumption of synthetic rubber. This does not mean, of course, that all synthetic consumed in the UK will come from ISR. The company already exports considerable quantities to all main rubber-consuming centres. It is likely that a proportion of the 15,000 tons by which the NRB estimates UK synthetic consumption will rise during 1960 will consist of more special purpose synthetic rubbers from dollar areas. Such an increase may also be expected following on the removal of restrictions on January 28 from four import categories, including synthetic rubber. It must, however, be remembered that USA imports are still subject to 10% duty. Those from Canada, on the other hand (notably from Polymer Corporation Ltd.), are duty free under Imperial Preference.

NEWS *Briefs*

DOW'S NEW PLASTICS SUBSIDIARY IN ITALY
I.C.I. TALKS IN POLAND — INDO-SOVIET MOVE
CANADIAN POLYMER CORP. AT FULL STRETCH

●**Italy** — Dow International have formed a new company, Dow Chimica Italiana SpA. Plans are being finalized for the construction of a multimillion dollar manufacturing plant in Italy. This wholly-owned Dow subsidiary will open its marketing office next month in Milan. A number of products are being considered for production, one of which is the entire Styron line (Dow Polystyrene).

●**Holland**—Dr J. Lever, Professor of Biology at the University of Amsterdam, has won the first award of the Royal Dutch/Shell prize worth £1,000. He found that the sea current sorts out sea shells into left and right hand varieties. Now geologists may discover, from this, current direction when prehistoric seas laid down sedimentary formations—helped by further experiments from Dr Lever, who is now working with highly coloured 'shells' made of plastic.

●**Canada** — Shipments of asbestos from Canadian mines rose 13.5% in 1959 to 1,050,703 tons from 925,670 in the preceding year. The year's exports climbed 17.0% to 1,013,922 tons from 866,630. December shipments from mines increased to 72,048 tons from 63,120 and exports to 110,924 tons from 81,386.

●**United States**—Apparently bidding for a strong position in the tyre field, Chemstrand Corporation says it has 'major expansion plans' to increase production capacity of nylon Type 66 by 'more than 50%.' Present capacity of Chemstrand's Pensacola plant is 114,000,000lb. a year. Currently under construction is a new nylon plant in Greenwood, South Carolina, with an initial rate of capacity of 10,000,000lb.

●**Japan**—Sumitomo Electric Industries Ltd. of Osaka, are to become shareholders in Dunlop's subsidiary in Japan with a holding of almost 29%. Major expansion is now planned, which includes the modernization and enlargement of existing manufacturing facilities in Kobe and the erection of a second tyre factory, probably in the Nagoya area, scheduled for completion by mid-1961.

●**United Kingdom** — The revised Board of Trade list of goods whose export is prohibited to the Soviet bloc and China includes pipe and tubing made of polytetrafluoroethylene, alkyl polysulphide liquid polymers and fluorinated silicone rubber which contains more than 10% of combined fluorine.

●**Italy**—A Sicilian company SpA Celene owned jointly by Union Carbide and Societa Edison of Milan, Italy, plans to double its polythene capacity. Located at Priolo, near Syracuse, the plant will have a capacity of 60m. pounds annually.

●**Canada** — Polymer Corporation is working at capacity; export demand for its synthetic is brisk and this year is expected to almost certainly exceed the record $75 million figure established in 1958 when output reached 130,000 tons. Demand for new rubber is increasing at record rates and in 1959 it jumped an estimated 14%.

●**United Kingdom** — Four hundred and fifty maintenance engineers at the Dunlop Rubber Company's factory at Speke, near Liverpool, were on strike on February 9 over a pay claim. A company spokesman said the engineers had demanded an immediate increase in pay outside any national agreement.

●**India**—India is to build a synthetic rubber manufacturing plant under an 85 million rupees Indo-Soviet agreement. This agreement covers the construction of plants to manufacture medical and surgical implements. A site has been selected in Hyderabad. A five-man Soviet delegation of pharmaceutical experts is in India to select sites for various plants to be set up under the agreement. The Soviet Union will supply equipment for the plant by the end of 1963, a spokesman said.

●**United States**—The B. F. Goodrich Company has announced it will build a tyre manufacturing plant near Fortwayne, Indiana, which will employ about 1,000 workers when in full operation. The 850,000 sq. ft. plant is being built to meet the anticipated expansion of the tyre market during the next five years.

●**United Kingdom**—Plans have been discussed between the Polish Government, Polish industrial leaders and I.C.I. to buy I.C.I.'s technical knowledge of polythene production, said S. P. Chambers, chairman-designate of I.C.I. on his return from Warsaw this week. Any arrangements would be between I.C.I. and a bloc of East European countries: Poland, East Germany, Rumania and Czechoslovakia. Further negotiations will probably take place in London.

'You the fellers who put in that suggestion about anti-vibration mountings?' — *471*

Polythene

PART II—HISTORY, STRUCTURE AND PROPERTIES

(Continued from February 6 issue, page 194)

By L. HINDS, Ph.D., B.Sc., A.R.C.S. (I.C.I. Ltd.)

THE first sample of polythene was made in March 1933, in the research laboratories of the Alkali Division of I.C.I. The discovery was not made in a search for a method of preparing polythene; it was made accidentally while the effect of very high pressures on a number of chemical reactions was being investigated.

In 1935, with improved apparatus available, the polymerization was repeated and this time, again, chance played a part. A leak in the apparatus necessitated an unforeseen addition of ethylene to the reaction chamber to maintain the pressure at the required value; the ethylene used happened to contain an amount of oxygen which catalyzed the polymerization of successive quantities of ethylene. This time 8g. of polymer were obtained, and the first preliminary evaluation could be carried out.

The similarity in structure, properties and applications between the polythene and gutta percha was very soon recognized, and the mechanical and electrical superiority of polythene over gutta percha and also over 'paragutta' which the Bell Telephone Co. had introduced specially for use in submarine telephone cables, directed the early development work into research on the possible uses of polythene in submarine cable technology. By 1939, little attention had been paid to other possible commercial outlets for polythene. There was, however, a considerable interest in the cable industry: there were high hopes that polythene might be the best insulant yet found for very high voltage cables.

At the very outset of the Second World War, an urgent need arose for a flexible high-frequency insulant for use in radar cables, and the output of the small plant which had been erected in Cheshire by the Alkali Division of I.C.I. was used solely for this purpose; no other material in existence was suitable.

The first new post-war development of polythene applications was in film. The very active American packaging industry gave polythene film its first impetus, and, within very few years, film was being produced by the elegant bubble technique all over the world.

The most important development, however, has been in injection moulding. During the war, the moulding of small radar components had been fairly easy, but it was only with the advent of large-capacity injection-moulding machines that it was appreciated that the most promising commercial development of polythene was in the field of medium-size and large-size mouldings for the most popular market of all—the home.

The Structure of Polythene

Chemical analysis of polythene shows quite simply that its formula is substantially $(CH_2)_n$, as is to be expected. As with most polymers, most of the information on its structure has been obtained by physical methods.

Infra-red absorption spectra show conclusively that polythene consists mainly of CH_2 chains; CH_3 groups are also detected, and for most low-density polythenes, the proportion of those groups is far in excess of that required for straight chain termination —in other words, the proportion of CH_3 groups shows that the chains are branched. Quantitative measurements on these polymers have shown that the average number of CH_3 groups per 100 carbon atoms varies from 1.8 at a molecular weight of 76,000 to 4.8 at a molecular weight of 1,700.

X-ray diffraction analysis of low-density polythene shows that at least a proportion of the material is crystalline. In these crystalline regions, the carbon chains lie side by side, as plane zig-zags in which the distance between the carbon atoms is 1.53 Å and the angle between the bonds is 112°; the zig-zag planes are

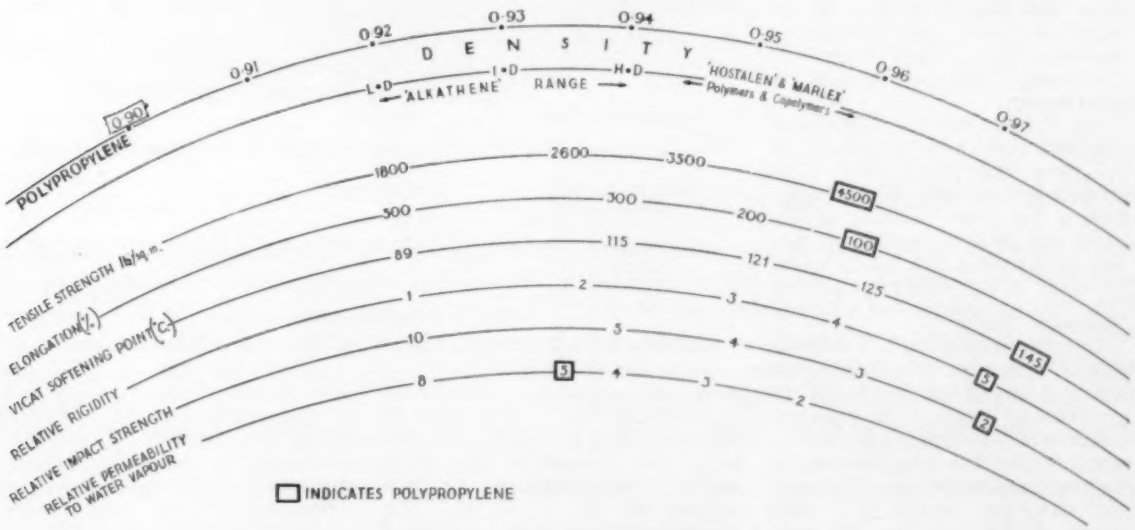

Fig. 1. Polythene density spectrum

not all parallel. The dimensions of the orthorhombic unit cell are: a=7.42 Å, b=4.94 Å, c(chain axis) =2.54 Å.

The density of the crystalline regions of polythene, calculated from these unit cell dimensions, is 1.00 at room temperature; amorphous polythene has a lower density. The measured density is a convenient indication of the proportion of crystalline to amorphous material in samples of commercial polythenes, and is normally measured in a density column. It has been shown that, at a given temperature, the proportion of crystalline to amorphous material depends mainly on the degree of branching of the molecules. A material, therefore, which has very little chain-branching, such as the polythene made by low-pressure processes, has a high degree of crystallinity and, consequently, a high density.

Fig. 1 shows how the properties of polythene depend on its density (at the same melt flow index). Polypropylene, a closely related polyolefine, has been included in the chart and it is interesting to note that its properties fall mainly within the range of high-density polythenes.

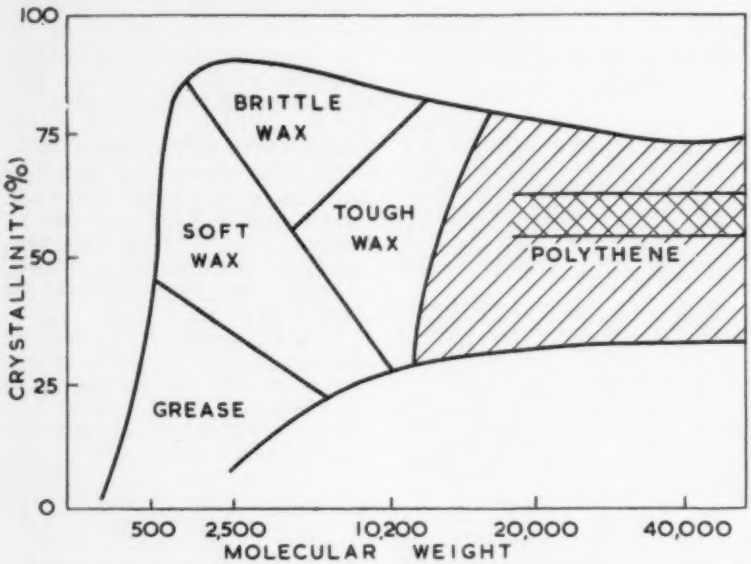

Fig. 2. Effect of crystallinity and molecular weight on physical properties

Molecular Weight

Different manufacturing conditions produce polymers which differ not only in degree of crystallinity but also in molecular weight. The main significance of molecular weight in practice is in the flow properties and in the mechanical properties. The higher the molecular weight the more viscous is the melt but the more favourable are the mechanical properties generally, especially the property of resistance to environmental stress-cracking, which will be discussed at greater length in a later chapter.

In practice it is found easier to make a viscosity measurement (at 190°C.) than to measure the molecular weight itself, and a quantity known as the 'melt flow index' derived from this measurement is normally used to determine the flow properties of a polythene.

The two variables of crystallinity and molecular weight result in a wide range of physical properties as indicated in Fig. 2. The range of polythenes that are useful as plastics is contained between the limits of 30 and 75% crystallinity, and molecular weights of 20 to 40,000. The boundaries of this range are enforced by considerations of toughness, flexibility, rigidity, brittleness and ease of manufacture and processing.

Properties of Polythene

Certain properties vary with melt flow index; others depend primarily on crystallinity (or density); others still are virtually independent of these two and depend only on the chemical constitution of the polymer. Table 2 shows these relationships.

Although polythene is only moderately strong, with a tensile strength in the region of 2,000lb./sq. in., its toughness and extensibility make it suitable for a large number of applications in the form of mouldings, film and extruded sections; it is insoluble in all solvents below 60°C. but some absorption of solvent may take place; it retains its flexibility to temperatures below −50°C. The impact strength of low-density polythene is remarkably high but polymers of higher density—and hence greater rigidity—have a lower resistance to impact.

Polythene is susceptible to a type of failure which in the past has caused much misunderstanding. While the failure of polythene to stand up to high stresses usually takes place in a ductile fashion, failure by cracking can occur at much lower stresses. Such failures are more likely to occur with material of higher density and are evident in low-density polythene only when an active environment (*e.g.* organic liquids, oils, fats) is in contact with the surface of the polythene.

An article moulded in polythene may, under adverse moulding conditions, contain frozen-in stresses; if, during its subsequent life, the article is exposed to active environments, the stresses in the material may be sufficiently large to cause cracking. Although the mechanism of this effect (called environmental stress-cracking)

TABLE 2

Properties mainly dependent on

Melt flow index (inversely related to molecular weight)	Crystallinity (density)	Chemical constitution only (*i.e.* virtually invariant)
Phenomena involving large deformations (up to fracture), *e.g.*	Phenomena involving small deformations, *e.g.*	Phenomena involving molecular deformations, *e.g.*
elongation to break*	melting and softening point	refractive index
tensile strength*	surface hardness	electrical properties
low temperature brittle point	elastic modulus	thermal conductivity
		specific heat
environmental stress-cracking	stress at yield point	thermal expansion
	gas permeability	decomposition temperature
	liquid absorption	

*At a constant MFI these properties are also dependent on density.

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is not fully known, sufficient information is available on the processing of polythene greatly to reduce this cracking hazard.

The electrical properties of polythene are one of its most important features. Polythene is suitable for both low- and high-frequency cable insulation and is also finding extensive use where high voltages are encountered. The most important electrical property is its very low power factor, which makes it particularly suitable for use with very high frequencies such as are encountered in TV and radar, and with radio frequencies where a very low attenuation is required, as in the trans-Atlantic telephone cable.

Table 3 gives the values of a number of properties which are also caused by exposure to ultra-violet light. When the material is intended for outdoor use it must therefore be further protected by the incorporation of finely-divided, well-dispersed carbon black.

TABLE 3

Properties mainly independent of melt flow index and density

Refractive index	1.51
Power factor (tan δ) at 1.6×10^7c./sec.	0.00005–0.0002
Permittivity from 50 to 10^{10} c./sec.	2.3
Volume resistivity	about 10^{19} ohm cm.
Surface resistivity (at 75% r.h.)	$>4 \times 10^{14}$ ohm
Dielectric strength at 50 c./sec.*	1,000 V./0.001 in. (400 kV./cm.)
Thermal conductivity	0.0034 joule cm./sq.cm.sec. °C. (2.3 B.t.u. in./sq.ft.hr. °F.)
Specific heat	0.55 cal./g. °C.
Specific heat (120–140°C.)	0.70 cal./g. °C.
Coefficient of linear expansion	2.2×10^{-4} cm./cm. °C. (1.2×10^{-4} cm./cm. °F.)
Decomposition temperature in vacuo	280–300°C. (535–570°F.)

*B.S. 771, specimens 0.20 in. (0.51 mm.) thick.

At temperatures above 80°C. polythene slowly oxidizes, the higher the temperature the greater being the rate of oxidation; it is often necessary to incorporate chemical agents to prevent or at least greatly reduce this effect. The main results of oxidation are an increase in the power factor and a deterioration of the mechanical properties. Oxidation is virtually independent of melt flow index and density.

(*To be continued*)

Plastics for Road and Rail

Southern Region trains have reduced costs by using reinforced plastics. Experiments went on for some time to try and obtain a lighter door—a saving of only 14lb. a door means a ton less for the average train to carry—before a door made from a structural laminate of Bakelite polyester resin reinforced with glass fibre was chosen. Trains with these doors are now in service.

Costs compare favourably with steel and aluminium, which were used before, and, of course, there is now no corrosion problem.

Extensive tests were carried out before the doors were put into service. A special test rig was devised to simulate the effects of continual heavy slamming, and a test rig was set up on which the three types of door could be compared. The results showed that the polyester/glass fibre doors had superior qualities to other types of doors tested where resistance to deformation and permanent set was concerned.

The doors are in large-quantity production at the S.R. Carriage and Wagon Works, Eastleigh. The production method is fundamentally the simple hand lay-up technique, modified to suit this particular job. Layers of chopped strand glass mat, impregnated with resin, are consolidated in a mould which is also made of polyester resin reinforced with glass fibre. The inside and outside halves of the door are made separately, and then immediately clamped together. In this way the halves are firmly bonded, and both surfaces of the door are smooth.

Another transport development—on the roads this time—is that of Samlesbury Engineering Ltd., of Samlesbury, near Blackburn, Lancashire, who are now producing 'frameless' road haulage containers made throughout from Bakelite polyester resin. The new containers are supplied with top or bottom lift and, in addition to having all the excellent mechanical properties of reinforced resin structures, are claimed by the manufacturer to be over 25% lighter in weight, and cost 25% less than containers made from more conventional materials.

The Samlesbury container is constructed from two basic types of panel—one for the sides and the other (translucent) for the roof. Each panel is flanged on all four sides and assembly is effected by securing the flanges of adjacent panels with nuts and bolts. Moulded-in diagonal reinforcing ribs, also based on Bakelite polyester resin, give the panels adequate rigidity, and the entire structure is secured to the floor and bearers by light alloy angle.

Minor repairs are simply and inexpensively carried out with resin and glass fibre or, if damage is more extensive, a whole panel can be replaced in approximately 30 minutes.

The bodywork and roof of this 1,050 cu. ft. road haulage container is made entirely from assembled prefabricated polyester/glass panels which require no expensive metal supporting framework

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F. J. Edwards Ltd., 359-361 Euston Road, London, N.W.1. have recently been appointed world selling agents for the new Ashley hydraulic four-pillar power presses. Offered in two platen sizes 16¾in. x 16in. and 25in. x 17in., with approximate pressures of 8 and 12 tons, these machines with a built-in hydraulic unit, are easily installed and completely vibrationless during operation. The pressure is evenly distributed over the whole of the platen working area between the columns. A conveniently placed hand-wheel is provided for very fine adjustment of the gap between the working table and top bolster.

Factice in Nitrile Rubber Compounds

By C. FALCONER FLINT*

IN the course of work designed to assess the help obtainable from the use of vulcanized fatty oil (factice) in compounding a nitrile rubber, experiments were carried out with a polymer† based on 45 acrylonitrile/55 butadiene, using a high loading of SRF black in the presence of an ester plasticizer.

The use of factice was found to give several advantages. At the loading studied (10 phr) noteworthy factice effects were:

(i) Promotion of extrudate quality.
(ii) Reduction of heat collapse.
(iii) Increase in tensile strength of the optimum vulcanizate.
(iv) Reduction of volume change in hot oil of the optimum vulcanizate.

The effect of factice on tensile changes due to oven ageing and hot oil ageing was observed to be negligible. Addition of the factice type recommended reduces the cost of the compound. The compound used was as in Table 1.

TABLE 1
THE COMPOUND STUDIED

	Parts by Weight
Butadiene/acrylonitrile (55/45) copolymer	100
SRF black	100
Di-octyl-phthalate	20
Zinc oxide	5
Stearic acid	1
PBN antioxidant	1
MBTS accelerator	1.5
Sulphur	1.5
Factice	0 or 10

Four factice types, taken from works scale batches, were compared (by addition) with the blank compound in the above formulation. Two of the factices were, respectively, FRADA grade one factice (RO1) and FRADA grade three factice (RO3), both based on rapeseed oil. The remaining two were, respectively, FRADA grade one factice (GO1) and FRADA grade two factice (GO2) both based on other glyceride oil.

The acetone extract values and free sulphur values for these four factices will be found in Table 2.

Scope of Investigation

The mixings were prepared on a laboratory open mill with roll surface temperature maintained at 80°C. Preliminary experiments, using determinations of tensile strength, ultimate elongation and 300% modulus on a range of press cures at 141°C., showed that 10 phr of any one of the four factices studied had a negligible effect on the time to optimum cure of this compound (Table 1). This conclusion was confirmed by studying charts obtained from an instrument designed to indicate 'shear modulus' changes during the actual vulcanization of the compound.

TABLE 2
ANALYSES OF THE FACTICES EXAMINED

Factice Designation	Acetone Extract‡ (%)	Free Sulphur§ (%)
RO1	14.9	1.9
RO3	42.2	2.5
GO1	18.7	1.2
GO2	33.1	2.5

‡ Five hours Knoeffler extractor.
§ Method of Bolotnikov and Gurova (see J. H. Carrington, *Trans. I.R.I.*, 1935, **3**, 302).

The next step taken was to observe effects on processing properties at the 10 phr addition level of these factices. Compounding time, mill running temperature effects, Mooney viscosity, Mooney scorch, dimensional stability, heat collapse and extrusion characteristics (Garvey die) were studied.

Attention was then given to the influence of a factice addition at 10 phr on the properties of the optimum vulcanizate. The effect (before and after oven and hot oil ageing) on tensile strength, 300% modulus, elongation at break and hardness was examined, as was effect on compression set and volume change in hot oil.

Summary of Observations Made

As a *processing aid* in this nitrile compound, 10 phr of factice would appear to give very valuable help in promoting extrudate quality, considerable help in preventing heat collapse, and appreciable help in reducing the time required for making up the compound. The effect of factice was to reduce tendency to scorch and there was a small but beneficial effect on mill running temperature effects. A small but definite tendency to stiffen the raw compound could be attributed to the factice and there is evidence that when a compound shows excessive nerve, the factice will exert a powerful effect in reducing this nerve and promoting docility to shaping.

The favourable effects of factice on the optimum vulcanizate properties of this nitrile compound were observed to include improved tensile strength and reduction of volume change in hot oil. Factice addition was seen to have a negligible effect on tensile changes due to oven ageing and to hot oil ageing.

In order to secure the advantages obtainable from addition of 10 phr of factice to this nitrile rubber compound, the factice type RO3 (see Table 2) would appear to be the best selection from the four types examined.

It was shown that although advantages of some value were secured by the addition of 10 phr factice to this nitrile compound, there was no increase in the cost of the compound. In fact, the addition of the factice made the compound cheaper per lb. volume and cheaper per lb. weight.

Economics of this Factice Addition

At the time of writing, the cost of the blank compound shown in Table 1 approximated to 35.5d. per lb. volume (for a discussion of volume costing see Falconer Flint, Rubber J., October 29 1955). The addition of 10 phr of RO3 factice reduced this figure to 34.4d. per lb. volume. The blank compound, at the time of writing, cost approximately 27.8d. per lb. weight and the addition of 10 phr of RO3 factice reduced this cost to 27.1d. per lb. weight.

EXPERIMENTAL

It it now proposed to give notes and specimen test results, selected from the data available, to support the conclusions drawn in the preceding section. Details of the test methods used will be indicated, by a reference where possible.

(a) Effect on processing

1. *Filler Incorporation Test*

For the results of this test, see Table 3. 200g. polymer were masticated for three minutes at 80°C. The time taken to incorporate 200g. of SRF black was recorded and taken as the filler incorporation time. In the factice compounds the factice was added after 1½ minutes' mastication.

2. *Mill Running Temperature Effects*

Measurements were made, during mill mixing of the compounds, of (i) maximum temperature reached during compounding, (ii) time to reach

* *C. Falconer Flint, Ph.D., D.I.C., B.Sc., A.R.C.S., F.R.I.C., F.I.R.I., is Director of Research, Factice Research and Development Association, 12 Brook Road, Fallowfield, Manchester, 14.*

† Chemigum N3 and Chemigum N3NS were used; but there would appear to be no reason why the results obtained should not be applicable to other nitrile rubbers.

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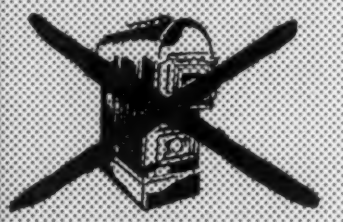

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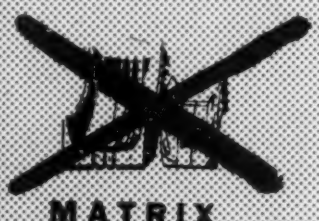

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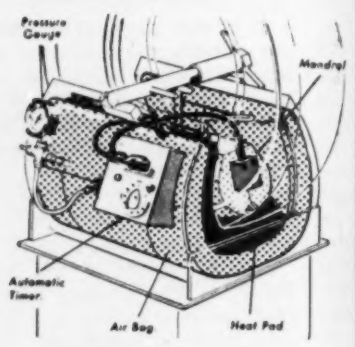

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this maximum temperature, and (iii) temperature at the conclusion of compounding. For this experiment, milling started with the mill rolls filled with water at room temperature but with the water circulating system sealed off from the mill rolls. Fractional advantages attributable to an addition of factice were observed.

TABLE 3
FILLER INCORPORATION TEST

Compound	Mastication time	Incorporation time	Total time
Polymer	3′	2′ 34″	5′ 34″
Polymer + 10 RO1	3′	2′ 17″	5′ 17″
Polymer + 10 RO3	3′	1′ 49″	4′ 49″
Polymer + 10 GO1	3′	1′ 43″	4′ 43″
Polymer + 10 GO2	3′	1′ 31″	4′ 31″

3. *Mooney Plasticity* (100°C.)

The results of this test are given in Table 4 and were obtained on the compounds, using a rotor 1½in. diam.

TABLE 4

Compound	Mooney Plasticity (4 mins.)
N.F.	112
RO1	119
RO3	114
GO1	115
GO2	109

4. *Mooney Scorch* (121°C.)

TABLE 5

Compound	Mooney Scorch Time* (mins.)
N.F.	18
RO1	19
RO3	21
GO1	18
GO2	19

* Time required to attain a viscosity increase of 2 units per min. Rotor 1½ in diam.

5. *Effect on Dimensional Stability of Raw Compound*

As regards help to be expected from factice in improving dimensional stability after the shaping of raw Table 1 compound by pressure, the polymers examined† gave such satisfactorily low Williams 'difference' figures (the difference between pellet height measured after compression by a fixed load and again measured after recovery from the load) that improvement from an addition of factice could hardly be expected and would bring little practical advantage. On the other hand, using a sample of polymer of similar butadiene/acrylonitrile ratio but of another type, the Table 1 compound proved to be very much more nervy in the absence of factice. Here, an addition of 10 phr of RO1 factice was observed to reduce the stock nerve (as measured by Williams 'difference' figures) to less than one-fifth of the blank value.

6. *Heat Collapse Test*

Table 6 gives the results obtained from this test. The samples for this test were 3in. long x ¼in. thick moulded for ½ minute at 141°C. The samples were tested at 70°C. in the oven by supporting them horizontally with 2in. of sample extending over the end of the support bar. Two methods of measurement were used:

1. The time taken for the end to fall three divisions on the arbitrary scale as the unsupported sample bends under its own weight.
2. The number of divisions the sample end has fallen, through the bending of the sample, after a period of 7 minutes.

TABLE 6
HEAT COLLAPSE TEST

Compound	Time taken to fall 3 divisions	Collapse after 7 mins.
N.F.	3′ 12″	4.75
RO1	7′ 0″	3.0
RO3	5′ 0″	3.75
GO1	5′ 0″	3.9
GO2	3′ 33″	4.3

7. *Garvey Die Extrudates*

Visual observation of Garvey Die extrudates (Falconer Flint, Featherstone, and Donnelly, *Trans. IRI*, 1957, *33*, p. 208) showed (see Table 7) that in quality the extrudates were in the following descending order: RO1, GO2, RO3, GO1, Blank.

Although the RO1 compound gave the best extrudate, it had the slowest extrusion rate. A table of observations made is given below. A 1½in. extruder was used with a scroll speed of 30 rpm.

TABLE 7
GARVEY DIE EXTRUDATES

Compound Extruded	Extrusion Rate (in./min.)	Description of Garvey Die Extrudate: Edge	Surface	Section
Blank	16	Very irregular	Very rough	Slightly swollen and irregular
RO1	13¼	Good straight edge	Smooth surface	Very good definition
RO3	16½	Slightly irregular	Smooth surface	Good definition
GO1	17	Very irregular	Smooth surface	Good definition
GO2	18½	Very slightly irregular	Smooth surface	Good definition

As indicated in the table, the main point of difference between the compounds containing factice was in the condition of the edge of the extrudate. All factices caused a good clearly-defined section and smooth surface.

Comments on Processing Observations

From the work described above, the following indications emerge regarding the value as a processing aid of an addition of 10 phr of one of the four factice types studied in the nitrile compound under consideration.

(1) Three of the factice types reduce filler incorporation time to a useful extent. The least effective type here appears to be RO1.

(2) Factice addition is of some slight help in promoting favourable mill running temperature effects.

(3) The effect of a factice addition appears to be a slight stiffening of the compound, of least magnitude when GO2 is used.

(4) Mooney scorch figures show that the tendency of the factice addition is to promote the safety of the compound, the effect being most marked in the case of the RO3 factice.

(5) With the polymers studied, there remained little scope for reducing the nerve (and hence promoting the dimensional stability) of the raw stock by means of factice. But using a nervy polymer of the same butadiene/acrylonitrile ratio, 10 phr of factice has been shown highly effective for deadening the raw stock and increasing docility to shaping.

(6) Figures given above show that a factice addition of 10 phr is a real help in controlling heat collapse of this nitrile compound and that RO1 is the most effective factice for this purpose. The type GO2 seems to be the least desirable type for preventing heat collapse in this nitrile compound.

(7) From the Garvey die results in Table 7, it will be seen that, at 10 phr addition level, all four factice types correct imperfections of surface and section in the extrudate but they vary in ability to correct edge defects, RO1 being best and GO1 ineffective. Effect on extrusion rate would appear to be small but in the right direction, save in the case of RO1. On the whole, selecting a factice for use as an extrusion aid in this nitrile compound, there would appear to be little to choose between GO2 and RO3.

(8) Taking a balanced view of the above, and including economic considerations, the factice type RO3 would appear to be the preferable selection for addition at 10 phr level to this nitrile rubber compound as a processing aid.

† Chemigum N3 and Chemigum N3NS.

(b) Effect on Optimum Vulcanizate Properties

TABLE 8

SUMMARY OF RESULTS AT OPTIMUM CURE (40 MINS. AT 141°C.)

		10 p.h.r. of:				
		Blank	RO1	RO3	GO1	GO2
Tensile (p.s.i.)	B.A.	1,547	1,682	1,757	1,735	1,575
	A.A.	1,662	1,800	1,715	1,932	1,700
	Hot oil A. ..	1,590	1,737	1,720	1,800	1,605
Mod. 300% (p.s.i.)	B.A.	1,547	1,592	1,473	1,627	1,477
	A.A.	—	1,800	1,697	1,932	1,700
	Hot oil A. ..	—	—	1,666	1,800	1,585
E. at B. (%)	B.A.	300	375	437	367	412
	A.A.	262	300	337	300	300
	Hot oil A. ..	262	275	375	300	362
Hardness (°B.S.)	B.A.	71	71	68	68	68
	A.A.	71	71	69	70	68
Swell (% volume change)		−2.2	+0.7	+0.5	+0.9	−0.05
Compression set* (%)		1.9	1.7	2.5	2.6	2.5

* Room temperature, 24 hours at 30% deflection between glass-paper surfaces: expressed as a percentage of the uncompressed original height.

B.A. = Before ageing.
A.A. = After ageing 14 days in an oven at 70°C.
Hot oil A. = After immersion for 24 hours at 100°C. in A.S.T.M. oil No. 3.
Swell = % volume change by volumetric method (B.S. 903, A.16) after immersion for 24 hours at 100°C. in A.S.T.M. oil No. 3.

TABLE 9

ASSESSMENT OF 10 P.H.R. FACTICE EFFECTS ON OPTIMUM CURE OF TABLE I COMPOUND

(Values before ageing given in Table 8 are here expressed as % of blank ('no factice') value)

	10 p.h.r. of:			
	RO1	RO3	GO1	GO2
Tensile strength	109	113	112	102
Modulus (300%)	104	96	106	96
Elongation at break	125	145	122	137
Hardness	100	96	96	96
Compression set	90	132	137	132
Volume change in hot oil	32	23	41	3

TABLE 10

ASSESSMENT OF 10 P.H.R. FACTICE EFFECTS ON AGEING OF OPTIMUM CURE OF TABLE I COMPOUND

(Values after ageing given in Table 8 expressed as % of corresponding unaged value)

		10 p.h.r. of:				
		Blank	RO1	RO3	GO1	GO2
Tensile strength	Oven ..	108	107	98	111	108
	Hot oil ..	103	103	98	104	102
Modulus (300%)	Oven ..	—	114	115	119	115
	Hot oil ..	—	—	113	111	107
Elongation at break	Oven ..	87	80	77	82	73
	Hot oil ..	87	73	86	82	88

Comments on Properties at Optimum Cure

From the above observations the following appears to be the effect of these factice type additions on the optimum vulcanizate properties of the nitrile compound studied.

(1) At 10 phr addition to this compound, examined before ageing, all the four factice type samples increase tensile strength and elongation at break. The effect on modulus is small and, in direction, depends on the factice type. There is a slight tendency to reduce hardness and (save in the case of RO1 which reduces set) compression set is increased. On the whole, as regards the effect on the properties of the unaged optimum vulcanizate, RO3 appears to be the preferable type.

(2) The factices have little effect on tensile changes due to hot air or hot oil ageing: RO3 appears preferable. The factices do, however, tend to increase the ultimate elongation changes due to oven ageing. Elongation changes due to hot oil ageing are variable. On the whole, RO3 again appears preferable. As regards the relatively small modulus changes due to ageing, there seems little to choose between the factice types.

(3) The volume change in hot oil is reduced very greatly by factice. The blank compound diminished in volume in hot oil, but the compounds containing factice show a much smaller change which is in the reverse direction (*i.e.* they show a small volume increase).

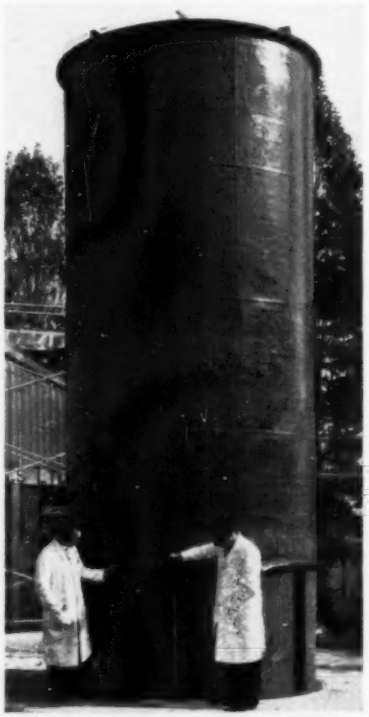
BS 3's First Trial

Pirelli BS 3 tyres with replaceable treads were used for the first time in a competitive event in the recent Monte Carlo Rally. Drivers reported enthusiastically on the tyre's performance, the company stated.

1960 'Warerite' Range

The 1960 range of 'Warerite' laminates contains 16 new patterns. These new designs from Bakelite Ltd. give a wider choice of scale and a more abstract type of design. Some of the designs are: 'Murano,' organic forms overlaid with a secondary pattern and punctuated with jewel-like inlays of colour; 'Alexandretta,' conventionalized drawings of human figures sealed in a kaleidoscope of colour; and 'Hedgerow,' a large-scale floral design.

The annual Industrial Welfare Society's one-day conference on 'Industrial Health' will be held at the Connaught Rooms, Great Queen Street, Kingsway, W.C.2, on February 16 1960, 10 a.m.–5 p.m.



What is claimed to be the first combination of rigid PVC with a polyester resin/glass fibre laminate in which a true bond has been achieved is a series of process towers and storage tanks manufactured by Cawley Plastics Ltd., Way Lock Works, New Haw, Weybridge, Surrey. The largest single structure in the contract is a process tower 36ft. high and of 4ft. internal diameter. Chemical storage tanks with capacities of 6,500 gallons are also included. The dual laminate used consists of Bakelite Vybak industrial rigid-PVC sheet, bonded to a strength-giving polyester resin laminate. The method of bonding employed is the subject of a patent application, and details are not disclosed. The illustrated tank is of 6,000 gallons capacity

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Preplasticizing in Injection Moulding

PI LONDON SECTION MEETING

A SHORT symposium on 'Preplasticizing in Injection Moulding' was held by the London Section of the Plastics Institute at the Wellcome Building on February 2 1960. The meeting, which was extremely well attended, was opened by the Chairman of the London Section, Dr J. Gadsby.

The first paper was contributed by Mr J. S. Walker (Fraser and Glass) who gave a brief historical review of injection moulding and described its present status. It was by no means a new development. A patent (describing the essential features) had been taken out by Hyatt in 1872. It was still believed by many that injection moulding was a complex, mysterious, and secret process, but it was actually a straightforward technique consisting, in the speaker's own words, of 'heating and squirting.' Recently the principle of preplasticization had been applied and it was interesting to speculate on the reason for this. The conventional machine, in use since the 1920's, moved the material by means of a plunger over a spreader, torpedo, and through the nozzle. Slight modification had occurred over the years, heating cylinders had become longer, larger, and heavier. Greater power was being employed to drive the machine, for example 8oz. machines which originally had been fitted with 5 hp motors were now fitted with 30 or even 60 hp motors. Preplasticization replaced this use of brute force by separating the two functions of the machine, *i.e.* 'heating and squirting,' and in so doing followed the die casting industry which had used this principle from its early days. Many advantages were claimed for preplasticization including:—

1. Better running.
2. Reduced strain.
3. Less distortion in mouldings.
4. Reduced locking pressure and tool costs.
5. Ease of ejection.
6. Allows use of powder instead of granules.
7. Better dry colouring.
8. Usually means faster cycle, but depends on ratio of machine/job.
9. Faster machine change with compatible materials.
10. Less likelihood of torpedo memory.
11. Measured volumetric feed and in many cases more consistent weight.
12. Faster mould fill at lower pressure. Therefore less hp required per lb. of material injected.

The process also minimized polymer degradation. At the same time it was suggested by various industrial users there were some disadvantages such as inclusion of air bubbles, especially in polythene, difficulty of changing with non-compatible materials, increased seepage back from ram and higher cost of the machines.

At the PI Symposium were (*top*): **C. Hamilton, of Hamilton Machine Sales, Dr Frimberger, of Ankerwerk, and J. Gadsby, Chairman of the London Section of the PI;** (*bottom left*): **A. Gaspar, Projectile and Engineering Co. Ltd., and R. Schooley, of R. H. Windsor Ltd.; and H. Timmer, Director of N.V. Werkmetaal, and Dr A. Kleine-Albers, of Ankerwerk**

Single Screw Type

Dr Frimberger, Ankerwerk Geb., who read the second paper, explained that his company had pioneered the single screw preplasticizing injection moulding machine and he would confine his remarks to single screw types. An examination of the conventional machine showed that the plasticizing speed was limited by considerations of thermal conductivity, that thermal homogeneity was not possible, that there was a great deal of granule compression, and that the flow characteristics did not facilitate mixing. By comparison a screw type machine gave two dimensional flow, consisting of longitudinal rotation and axial displacement, along the whole length of the screw. This caused all the melt to be thoroughly worked. Additionally, heat was introduced in two ways, by conduction from the cylinder walls and also by intergranular friction. The latter was a most important feature, as it was possible by design, to decide whether to introduce heat by conduction or by friction. In some cases it was possible to work by friction alone. As the viscosity of the melt fell the shear fell also, which reduced the heat developed. This led to thermal stabilization and the introduction of closer temperature control than was possible with ram types.

The increased plasticizing capacity led to greater output and the effect was particularly noticeable with high melting point or materials difficult to melt. Mention was made of polymethyl methacrylate, nylons and HD polythenes of high molecular weight. Improved melt quality was not easily analysed but among the results were mouldings having superior homogeneity as shown by microphotographs of nylon mouldings examined by polarized light. Injection pressures were considerably lower using the screw type as compared with the ram type. The effect was particularly noticeable with certain difficult materials. For example rigid PVC required 35,000 psi in a ram type as against 11,400 psi in a screw type, and polyvinyl carbazole required 28-

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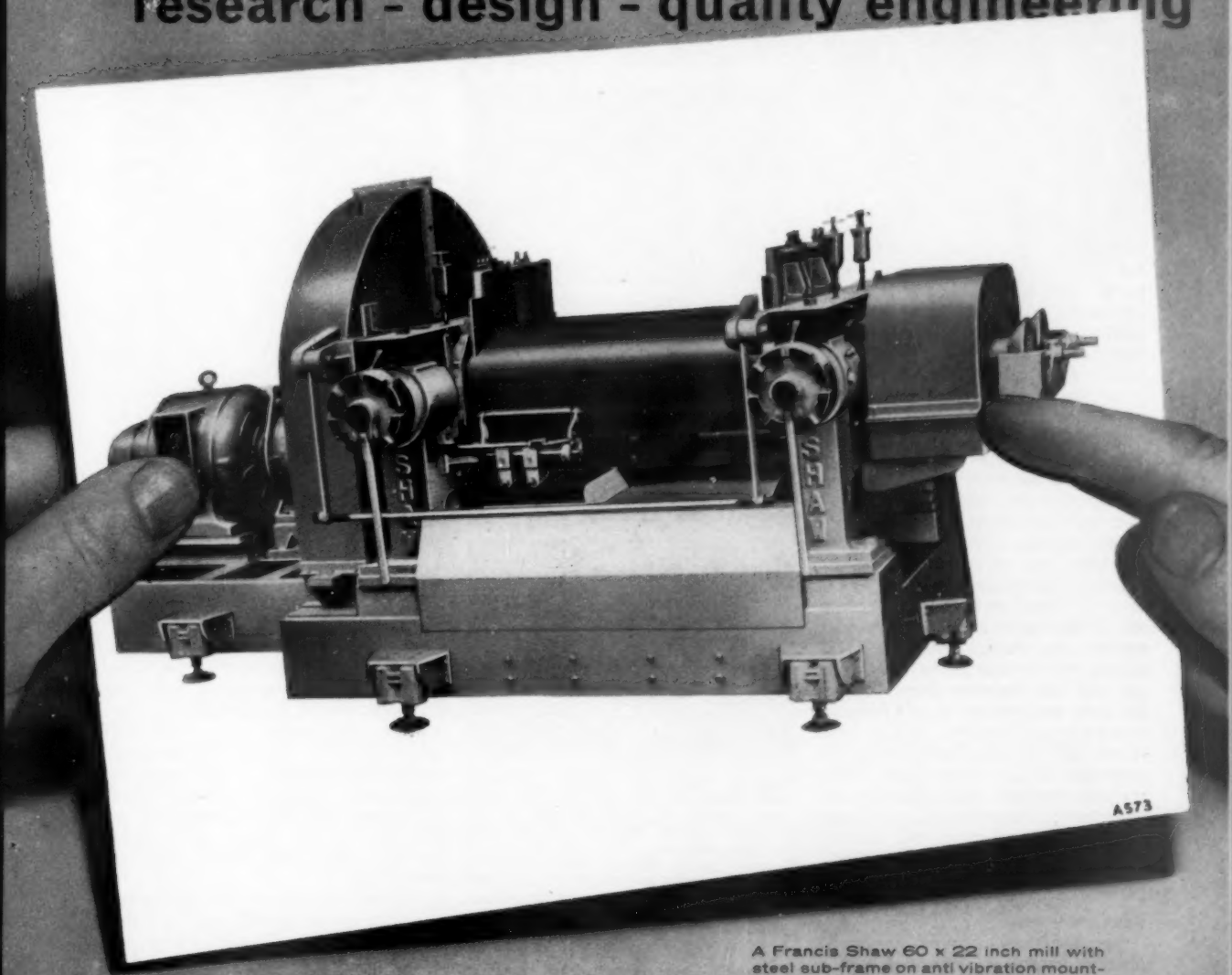

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OVERSEAS AGENTS THROUGHOUT THE WORLD

56,000 psi in a ram type as against 7,700 psi in a screw machine.

Speed of injection was also improved with the screw type machine which developed maximum pressure almost immediately. On a ram type, the initial pressure was taken up by the compression of the granules. An advantage of the high flow rate was that very favourable wall thicknesses could be obtained.

Mr A. Gaspar (Projectile and Engineering Co. Ltd.) who contributed the third paper, referred to comparison between a particular type of preplasticizing injection moulding machine and the conventional ram type. In a previous paper in 1957 he had concluded that preplasticizing led to various advantages including better cycling, greater dimensional consistency in mouldings, better utilization of mould closing pressure and better quality mouldings as a result of reduced moulding stresses.

In the three years which had passed the experience gained had led to emphasis on certain other features. The PECO in-line type of machine heated the material, pumped it into an injection pot, where the temperature was maintained and from which it was injected under pressure. The machine was characterized by its simplicity, streamline flow and avoidance of 'dead spots.' The material was forced into the injection pot at one end and pushed out at the other so that the pot was swept clear. The pot and the polymer were kept at the same temperature so as to control expansion and leakage. It had been found that the temperature could be controlled within narrow limits. The material reached the injection pot via a narrow channel and it was found that in passing through this channel a temperature rise of up to 25°C. could be attained.

Pressure Control

Preplasticization gave improved pressure control as compared with a normal ram type in which, at the end of the stroke, there was an uncontrolled rise in pressure. The injection plunger of the preplasticizer machine, which was designed to minimize pressure losses, was worked to very close tolerances. It was possible to do this with the very good temperature control obtainable.

Accurate volume control was also obtained, the pre-filling of the injection pot was gradual and under pressure so that voids were eliminated. Maintenance of correct pressure at the end of the stroke was important as loss of pressure resulted in 'sink marks' and excessive pressures to stresses in mouldings.

Fast filling rates had been achieved without precompression. In the early days of preplasticization emphasis had been laid on the relatively low injection pressures but restricted gating or pin gating had shown advantages. Although colour dispersion showed an improvement over the ram type it could be further improved by the insertion of a dispersion nozzle, consisting essentially of a perforated plate. This did not complicate material colour changes as the heat rise in the material when passing through the nozzle rendered it self-cleaning.

Among the very nearly capacity attendance at the Symposium were *(left to right)*: **C. Bendall and W. M. Morgan from Phoenix Telephones Ltd.** *(top picture)*, **R. J. Matthews, S. Russell and H. Wilson from Injection Moulders Ltd.** *(centre)* **and A. N. Byford and F. Sexton, Mentmore Manufacturing Co. Ltd.**

Most polymers could be handled with this type of machine, certain polymers including polycarbonates, cellulose acetate, cellulose acetobutyrate and nylon showed some resistance to pumping through the preplasticizing chamber and in consequence higher pressures were required. Unplasticized PVC was not handled as well as in a screw type machine.

Twin Screw Machines

The final paper by Mr K. H. Baigent (chief designer, R. and H. Windsor Ltd.) was read by his colleague Mr Schooley. He pointed out that screw type machines represented the latest development and his remarks would be confined to the twin screw type. In the particular machine with which he was dealing the screws were parallel, of identical dimensions and rotating in the same direction. The design of the screw was such that there was virtually no compression ratio. The material followed a continual figure eight movement along the screws and the forward movement resulted from the transference from one screw to the other. In the twin screw machine no reliance was placed on frictional forces between the screw and the barrel as in the single screw machine, but there was a complex turbulence created when material transferred from one screw to another. It was possible to achieve some analysis of the actual course of the material between the flights and this was illustrated by means of diagrams. Where work was done on the material energy was used up which resulted in a rise in temperature. This gave a good plasticizing effect at comparatively low barrel temperatures and as the heat was developed within the material itself also led to good thermal uniformity.

Dry Colouring Technique

In all preplasticizing machines the thermal uniformity was an important feature and was responsible for the advantages of this type of system. Among the improvements achieved were increased injection speed, increased shot weight or a reduction in the pressure required for the same shot weight, reduction in stress in mouldings, leading to the possibility of thinner wall sections, reduction in locking forces related to mould surface area and lower transfer pressure.

The process was notably successful with dry colouring techniques and the speaker mentioned a particular example in which TV implosion guards moulded from polymethyl methacrylate had been produced having good optical properties and showing very little residual moulding strain. In tinted screens successful dispersion of colour had been obtained using as little as 46g. colour to 1cwt. of moulding material.

Although preplasticizing had solved many problems in injection moulding it was not the final answer. It was still developing and in many ways injection moulding remained an art.

Brains Trust

It is possible to mention only a few of the many questions asked during the lively discussion period that followed.

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SHELL

Opening the discussion, Mr Martin (Fraser and Glass) said that one particular query which occurred to him was that, on the Continent, screw machines were almost universal whereas in the USA they had been little developed and he wondered whether there was any basic reason for this.

Mr Walker suggested that the patent situation was probably responsible. Dr Frimberger agreed that the patent situation might be responsible but pointed out that his company had sold screw type machines in the USA.

A further question concerned the percentage of leak-back occurred when screw systems were used as rams. Mr Baigent said that a certain amount of flow back occurred and it depended on the viscosity of the material and operating conditions. With polystyrene it was up to 10%, polythene rather more and polymethyl methacrylate, about 3%.

Dr Frimberger pointed out that with single screw machines a non-return valve could be used to prevent back flow but, in the ordinary way, it did not appear to be important. It was found that greater losses occurred, particularly in polythene, as a result of shrinkage.

Screw Profile

Mr James (G. H. and J. Daniels) noted that in some machines the volume of the shot was adjusted by means of the forward stop on the ram. Quite apart from leakage he wondered whether pressure losses did not arise as a result of shrinkage.

Mr Baigent replied that this effect was not noted as there was a large mass of molten material in front of the plunger. It had even been found advantageous in some cases to reduce the pressure before the stop.

Questioned as to what extent the screw profile was important in terms of output and efficiency, Dr Frimberger replied that in the single screw machine, if the screw was of a correct basic design, it did not show much difference when handling different materials. In practice, one shape of screw had been found satisfactory. Mr Baigent pointed out that the screw did not play the same part as in extruding; its function was simply to plasticize and it could be regarded in many ways as a pump with a screw action.

Mr Kennaway (Metal Box Co. Ltd.) said that some of the panel members had implied that valve gating and precompression could bring conventional machines up to the level of preplasticizers and wondered whether these effects were additive. He also wondered whether it was necessary to buy the latest model machine produced or whether it was possible to convert older types.

Mr Gaspar said the precompression was a half-way stage towards preplasticization and was a method which could be used with existing machines. The effect was certainly additive to preplasticization but higher injection pressures were required. Dr Frimberger said that one of the main problems was to reduce injection pressure because the rising pressure at the end of injection was a marked disadvantage. High injection speed was obtained with screw machines from the beginning and this was not the case with standard machines.

Mr Baigent pointed out that with precompression, one did not get an 8oz. shot out of an 8oz. machine. If the material was precompressed and allowed to expand, it was still necessary to follow up the expansion.

Mr McNeil (Kent Mouldings) asked what were the drawbacks encountered with pre-plasticization. Mr Walker said that each type of machine had its own particular problem but in every case the advantages gained easily outweighed the difficulties. Dr Frimberger said that on standard ram types there were many problems still encountered but on the single screw machine, most of these problems had been eliminated.

Mr Groves (B.I.P. Engineering Ltd.) wondered at what size of machine preplasticizing should come in. Mr Walker thought that even the smallest machine showed advantages. Dr Frimberger said that quality advantages showed up with any size machine but pointed out that the disadvantages in the smaller machines in respect of mouldings did not show up so much and could be overlooked. The choice was largely a matter of economics.

Mr Maitland (E. K. Cole Ltd.) asked whether the good effects of preplasticization could be nullified by Baigent said that the better flow with preplasticization still resulted in higher rates even with gate type moulds.

Dr Frimberger thought that single screw type machines might have limitations with long runners or thin gates. This could be overcome by the use of high pressures but they had not designed and did not wish to design a machine for high pressure work at present. Mr Gaspar thought that hot runners with preplasticization would add to its advantages.

The proceedings closed with a vote of thanks to the speakers, proposed by Mr D. Grant, who made special mention of the very good impression made by Dr Frimberger who had given his paper and joined in the discussion in excellent English.

Sumitomo and Dunlop

As reported elsewhere in this issue, the Japanese company, Sumitomo Electric Industries Ltd., of Osaka, are to become shareholders in the Dunlop subsidiary in Japan with a holding of about 29%, the Dunlop Rubber Company announced in London last week.

Under the terms of the agreement, signed in Kobe last week, Dunlop Japan is to increase its issued share capital from 500,000,000 yen to 1,750,000,000 yen by the capitalization of reserves and the subscription in cash of 750,000,000 yen by Dunlop England and Sumitomo. Dunlop Japan recently celebrated the completion of 50 years of manufacture of rubber products in Japan and until now has been wholly owned by the parent company.

A constantly lit 'finger of light' was the dominating feature of the recent Furniture Exhibition. 120ft. high, it was made by Rotaflex from British Celanese acetate moulding powder.

An interior view of London's new-style taxi. The inside door trim of all four doors as well as the inside wheel-arches in the passenger compartment are equipped with 'Royalite' nitrile thermoplastic made by The North British Rubber Co. Ltd., at Castle Mills, Edinburgh. The body work of this new London taxi is by Carbodies Ltd., of Coventry

VIEWS and REVIEWS

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **Dr Schidrowitz**

Effect of Iron on Ageing

IN 'Views and Reviews' of December 5 1959, *RJIP*, Vol. 137, page 726, I made some remarks on the 'Effects of metal contaminants on ageing,' these being indeed a comment on 'The Ageing of Rubber: Effect of Metal Contamination.' This was a paper read before a meeting of the Manchester Section of the IRI on March 24 1958, by B. N. Leyland and R. L. Stafford (Imperial Chemical Industries Ltd., Dyestuffs Division, Polymer and Chemicals Service Dept.), and reprinted from *Transactions of the Institution of the Rubber Industry*, Vol. 35, No. 2, 1959, pp. 25-44.

In regard to this subject, Monsieur R. Hublin, Director of the Ecole d'Enseignement Technique of the Institut Français du Caoutchouc, has kindly drawn my attention to three papers describing work at the IFC. These are as follows:

1. Mechanism of Protection by the Deactivation Effect, by J. Le Bras, J. C. Danjard and Mlle. M. Boucher.
2. Development of Tackiness in Vulcanized Rubber and Protection against this Development, by J. C. Danjard, L. Toullec and A. Langlade.
3. Effect of Iron on Heat Ageing of Vulcanized Rubber, by P. Fauvarque.

'You will notice in particular that we confirm the extremely harmful action of iron compounds in certain cases.'

M. Hublin points out that many industrial mixes contain iron oxide and other iron compounds which could explain many cases of poor ageing.

The French Papers

Unfortunately, I have not room to discuss these interesting papers at any length and I cannot do more than give a brief summary.

The first paper, by J. Le Bras *et al.*, relates more particularly to a study of the behaviour of the zinc salt of mercaptobenzimidazole as an antioxidant in rubber. Relaxation tests were made on the vulcanized rubber, and according to the English summary of the paper, it may be concluded from these tests that the zinc salt of mercaptobenzimidazole acts by creating inter-molecular cross-links during ageing of the rubber. Thus the antioxidant rebuilds part of the three-dimensional network of bonds which have been destroyed by heat and oxidation.

The second paper is concerned with an investigation into the tackiness which may develop as a result of ageing of vulcanized rubber. This is by J. C. Danjard *et al.*, who have developed a method for the accurate reproduction of tackiness, details of which are given in the paper. A test method for the numerical evaluation of the property of tackiness is also described and the authors suggest a combination of antioxidants for ensuring protection against the development of tackiness as a result of ageing of the rubber.

The third paper, by P. Fauvarque, constitutes an extensive research into the effect of the presence of iron and iron compounds on the ageing of vulcanized rubber. In the introduction, the author mentions that the harmful effects of copper and of manganese on the ageing of rubber have been studied extensively although there is relatively little information on the effect of iron. In the present work, iron powder and several compounds of iron were mixed into rubber containing different accelerators. From the results of ageing tests at 80°C. in air on the vulcanizates, the author concludes that iron is harmful to rubber only when it is in ionizable form, the metal itself or a complex compound being without effect.

A point of special interest is that certain iron compounds were found to be particularly harmful in a sulphurless mix, although such a mix is normally very resistant to heat ageing. This result is in agreement with the work of Leyland and Stafford, who, as I remarked in my review of their work as referred to above, found that ferric stearate was pro-oxidant in a sulphurless mix.

Readers requiring further details of Fauvarque's interesting paper will find a full English translation in *Revue Générale du Caoutchouc*, Vol. 36, No. 5, May 1959, pp. 695-698.

Latex Preservation Systems

My review of the article 'Low Ammonia Latices' (*Planters' Bulletin*, January 1960) is concluded below:

Method of Use

The paper in the *Planters' Bulletin* gives particulars of method of use. The amount required varies according to the source of latex.

Quality of the Latex

Boric acid preserved latex is a good low ammonia latex. In many cases it can be substituted directly for fully ammoniated latex concentrate without modification of the users' procedure. In other cases some alteration is needed before the changeover can be effected. Criticisms of boric acid latex have included the following:

1. On prolonged storage some deterioration occurred in certain cases. This is believed to have been due to bacterial growth which can be stopped by the addition of small amounts of bactericides.
2. It has a lower chemical stability and thickening can occur on extended storage after compounding.
3. The presence of borates reduces the speed of vulcanization of latex compounds and, if no adjustment is made for this, foam rubber prepared from boric acid latex may have a lower hardness.
4. It has been alleged that unvulcanized films prepared from boric acid latices have poor ageing properties but we have not been able to substantiate this statement.

These defects can be corrected by suitable modification of the compounding formulation and for most applications the advantages outweigh the defects as may be seen from the figures which follow.

World Consumption

The commercial production of boric acid preserved latex began in 1957. In a little over two years 1,629,858 imperial gallons of this latex containing 4,150 long tons

Continued on page 248

MEN and MATTERS

A Review of People and Events

by George A. Greenwood

THERE were references in the news and editorial columns last week to that interesting event which took place at the Science Museum, South Kensington on February 3, when the permanent display which the British Rubber Industry has presented to the museum was handed over. The celebration of this event was marked by a Press party when the president of the Federation of British Rubber and Allied Manufacturers, Mr H. G. W. Chichester-Miles formally made the gesture of handing over this most important and significant gift. It must be a landmark in the Federation's history. It is certainly one of great value to the nation.

We met, appropriately enough, in rooms which adjoin the Industrial Chemistry Gallery, where the display is now housed. There was ample opportunity for all the guests, Press and otherwise, to take a close view of the contents of the showcases and the murals which illustrate by means of maps, paintings, charts, photographs, and nearly 100 models, the production of natural and synthetic rubbers, its uses and manifold applications.

It is a remarkable building, this museum in the heart of colleges and museums on the south side of Hyde Park, and when I got there, a little while before the opening ceremony, I was a good deal interested to note long before noon, the scores if not hundreds of young people who were looking round at the almost incredible variety of machines and gadgets which, in their general use in factories and workshops, help to keep the wheels of British industry spinning round. The very sight of these absorbed young folk in their late teens and early twenties, made me feel how valuable it was going to be that in the future they should have a chance of noting the methods used in the processes of rubber manufacturing, and the varied and important part which the products that come out of it all play in every phase of modern life and human achievement.

A Fitting Tribute

Mr Chichester-Miles paid fitting tribute to those who in the background have worked so hard to assemble and to organize this notable gift which in its way commemorates the impressive record of the rubber industry in this country since 1820.

The formalities of accepting this valuable gift devolved upon Dr T. C. S. Morrison-Scott, director of the museum, who made it perfectly plain how much his chiefs and himself appreciate it. It is greatly to be hoped that this magnificent exhibit presented by an industry which has not only a notable past but such a great future in front of it, will capture the imagination and the inspiration of young people to whom it is designed particularly to appeal.

Apart altogether from the significance of gatherings like these, they are of value and interest because they bring so many of us with such varying associations together to exchange experiences and ideas. Personally I was able to renew a round score of old associations and to make many new ones. There are few industries within my knowledge where the spirit of cameraderie is so all-pervading.

E. Ronald Crammond

I am sorry to have to note the death which occurred in an Eastbourne nursing home a week or so ago of Mr E. Ronald Crammond, for many years an outstanding figure in British industry and commerce. To many of us, especially those who have, or have had, associations with the Midlands and with plastics, Mr Crammond will be remembered for the years of service which he rendered as a director of British Industrial Plastics, of which he was for a time chairman.

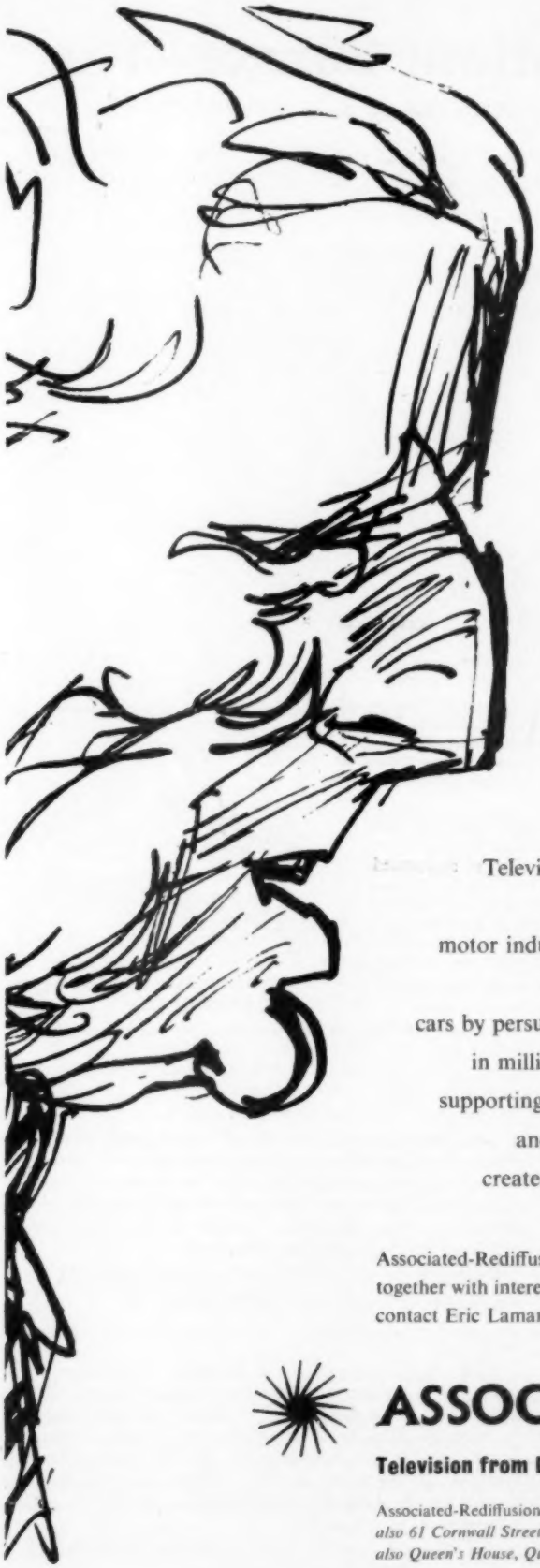
In the wider sphere, however, he was a noted financier, for many years managing director of the British Shareholders Trust in which he had joined his father, then managing director, after war service. It was from the start an important issuing and finance house, centred in Birmingham for many years until it moved to the city of London, and through it he was responsible for a large number of important marketing operations both during the between-the-war years, and after 1945. Mr Crammond, in fact, retained his association with the B.S.T. until 1955 when the Trust was acquired by Philip Hill, Higginsons and Co. After that he devoted himself to his other industrial interests, including British Industrial Plastics, the National Canning Co., Stone-Platt Industries, the Rank Organization, and so on.

To the outside world he appeared to be a man of reserved and uncommunicative character. In fact, among his close friends and professional associates, he was one of kindliness and charm, combining unusual ability and judgment with geniality and a sense of humour. He was a widower, but two sons survive.

Not In Idleness

When, a few weeks ago Sir Walter Worboys retired from the board of I.C.I. after 34 years with that company, I hazarded the opinion that he was not going to lead a life of idleness, either merely playing golf or growing cabbages. I was right to quite an extent. Although it is a fact that Sir Walter has now retired also

A. H. Pendree (*right*), sales director of the Goodyear Tyre and Rubber Co. (G.B.) Ltd., being congratulated by Goodyear's managing director, M. S. Meyer, after receiving his 30-year service pin



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from his position as chairman of the Council of Industrial Design, he remains a director of the Westminster Bank, and he has also been elected to the boards of BTR Industries, and the Associated Portland Cement Manufacturers and the British Portland Cement Manufacturers.

MB Plastics Changes

Dr G. Swift becomes sales manager of the Metal Box Plastics Group, following the appointment of E. R. Conradi, former sales manager of the group, to be general sales manager of The Metal Box Co. Ltd. Dr Swift was previously technical service manager. Other changes in the group are: J. M. Jackson, formerly development manager, becomes deputy to the general manager of the Plastics Group, D. J. Liston. Dr W. G. Barb, Plastics Group technical manager, assumes additional responsibility for co-ordinating the buying activities of the Plastics Group.

Dr G. SWIFT

On Safari

While still on the personal note I may add that Mr Alan Marshall, chairman of Seafield Amalgamated Rubber, has just begun a tour of 150 estates covering 100,000 growing acres in Malaya.

This combine makes progress. Since it entered the City market in 1958, Mr Marshall's enterprise has acquired eleven subsidiaries. The latest, I believe, is Bukit Rajah, with 5,990 acres in Selangor.

Question Corner—104

(Second Series)

429. What are the main ingredients used in compounding epoxy resins?

(Answer next week)

Answer to Question Corner—103

428. The name vinyl toluene has been accepted so as to avoid any mistake in identity with α-methyl styrene, but the proper names are o-, m-, and p-methyl styrene.

In one method of production ethylene and toluene are mixed, in the presence of aluminium and hydrogen chloride under anhydrous conditions, and the toluene is alkylated to produce the isomeric toluenes and more highly alkylated toluenes. After final purification a mixture of m- and p-vinyl toluenes are produced.

The polymer obtained from this mixture of monomers is a transparent, hard, colourless solid, similar to polystyrene. However, there is a higher tensile strength and elongation, while the heat distortion temperature and impact strength is somewhat lower than that of polystyrene. It is not compatible with polystyrene.

Vinyl toluene is useful in the surface coating industry as a replacement for styrene in the production of styrenated oils and alkyds. The higher boiling point (171°C.) of the monomer mixture is an advantage as higher reaction temperatures may be employed. The product is also more soluble in aliphatic solvents, which is a useful property for protective coatings.

Further data may be found in *Paint Manufacture* 1954 June, 207, and July, 243; *Off. Digest*, 1954 October, 951, and 1955, March, 148.

(Another question next week)

The closing date for the RIV Company International Plastics Competition—which has prizes of £9,000 for designs in plastics—is April 15 1960. Details from RIV, Sezione Materie Plastiche, Corso Giambone 33, Turin, Italy.

'Bias cutter — a human relations expert'

VIEWS AND REVIEWS

Continued from page 245

dry rubber have been shipped from Malaya. It is evident that boric acid preserved latex has found commercial acceptance, particularly in Europe, and that its production is already an important contribution to the quantity of low ammonia latex produced. We expect that low ammonia latices will form an increasingly large proportion of total latex concentrate production. It remains to be seen whether any one of those presently produced will become dominant or whether similar preservative systems, still on the research bench, will eventually prove superior.

I cannot go into the minute particulars of use, but it may be mentioned that the addition of boric acid reduces the mechanical stability of low ammonia preserved concentrate, but this may be corrected by the addition of a small amount of ammonium laurate.

Advantages

Much of the detail of the process must be omitted here but a few points may be mentioned. The first point in most standard processes based on ammonia preserved concentrate is to reduce the ammonia from 0.7% to 0.2%. This de-ammoniation is rendered unnecessary by the use of boric acid preserved latex or other low ammonia latices. Boric acid is not poisonous. It has no dermatitic action and is easier to handle than ammonia.

Rubber films prepared from boric acid preserved latex are lighter than those from other latices.

Cost

Boric acid (especially 'technical') is cheaper than ammonia but the cost of the soap required partly offsets this. When the boric acid is added to concentrate it is necessary initially to produce a concentrate of slightly higher drc to accommodate the dilution caused by the addition of the boric solution. The result is that the overall cost is about the same as that of normal ammoniated latex.

PHILIP SCHIDROWITZ

Science Museum Display

PRESENTATION BY H. G. W. CHICHESTER-MILES

IN presenting the Rubber Industry Showcases to the Science Museum on February 3 (as reported in *RJIP* last week) Mr H. G. W. Chichester-Miles, president of the Federation of British Rubber and Allied Manufacturers, said that the occasion was one of those pleasures and privileges associated with his term of office.

Before the official presentation, Dr T. C. S. Morrison-Scott, director of the Science Museum, Mr H. G. W. Chichester-Miles, president of FBRAM, and Mr E. S. H. Janes, chairman of the Federation's Publicity Committee view the rubber industry showcases

Mr Chichester-Miles went on:

'The display which has been subscribed for by manufacturers of rubber products (mostly members of our Federation); by manufacturers of synthetic rubber, chemicals machinery and components; by The National Rubber Development Board and The National College of Rubber Technology.

'To all these important firms and bodies our grateful thanks not only for the financial contribution, but also for active and valued collaboration in organizing the display. Mr E. S. H. Janes, chairman of our Publicity Committee, together with the subcommittee appointed for this special task, is entitled to our highest praise. We record a very high tribute to him and his committees for the enormous amount of devoted work in the devising and supervision of the project. He has been seconded by the unflagging enthusiasm and efficiency of our worthy secretary, Miss Chenhalls.

'Now about the display. It emphasizes the great variety of the rubber industry, its materials, processes and products; its scientific basis in the modern understanding of molecular structure and high polymer chemistry; its close connexion with almost every other industry and the vital part which rubber plays in every phase of modern life and human achievement.

'Like most of my colleagues, I am proud to be a member of the rubber industry. It is comparatively old, say 140 years, and has naturally developed traditions, but I am certain it is very young in outlook and is keeping pace with the rapid discoveries in science and technology. It is one of the ten largest industries in the country employing over 120,000 people, and using a quarter of a million tons of rubber a year.

'During the last 30 years its evolution has vastly quickened and scientific discoveries have been rapidly adopted to the great advantage of industry and the public. Disraeli said "By what man has done we learn what man can do and gauge the power and prospects of our race."

'To the Rubber Industry virile, enquiring, progressive in thought and action there is a great future, and I am hoping that the display, now housed in such a suitable environment, will capture the interest of young and ambitious people upon whom the future of this industry, and indeed this country, depend.'

Mr Chichester-Miles then officially handed over the showcases to Dr T. C. S. Morrison-Scott, director of the Science Museum.

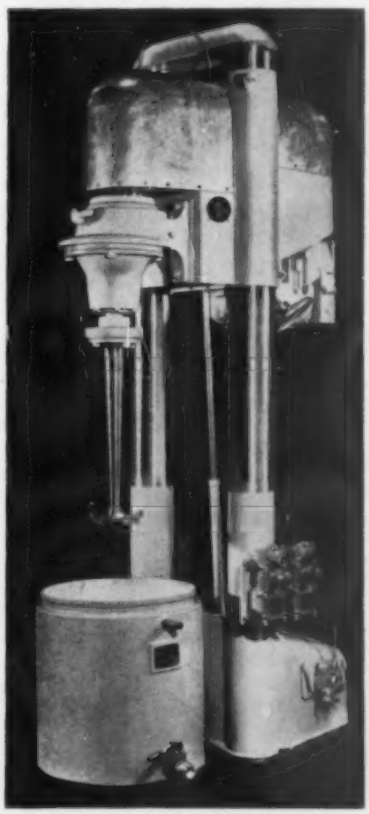
OCCA 1960

Exposure panels of coatings based on Pliolite S-5, subjected to normal British weather conditions for varying lengths of time, will be on show at the Goodyear stand at the technical exhibition of the Oil and Colour Chemists' Association which opens on March 15 at the Horticultural Hall, London. S-5 bases and Pliolite resins are being formally introduced into the UK for traffic stripes.

Steele and Cowlishaw will exhibit their new Steel-Shaw Rapid Disperser. The makers claim many applications for this, especially where finely divided solids are required to be quickly dispersed in viscous solutions of resins, varnishes, lacquers, etc.

Recent developments in amino and alkyd resins for industrial stoving enamels will be featured on BIP Chemicals' stand. These include a urea/epoxy co-condensate which can be used alone or in combination with oil modified alkyd resins.

CIBA will show 'Araldite' epoxy resins for surface coating and anti-corrosive purposes. They include cold-setting formulations for use on wood, plaster, plastics and other materials, and resins for stoving finishes in the electrical, food processing and chemical engineering industries.



Steel-Shaw Rapid Disperser

Institution of the Rubber Industry

NEW SECTIONS IN CEYLON AND RHODESIA

AT a meeting of the Council of the Institution of the Rubber Industry held on January 26 1960, the following elections were made:

Officers and Committees 1960:

Chairman of Council, Mr George Martin. Vice-Chairman of Council, Mr S. D. Sutton. Chairman of the Examinations and Qualifications Board and Education Committee, Dr C. Falconer Flint. Executive Committee (to fill vacancies), Dr W. C. Davey, Mr L. R. Mernagh, Mr F. M. Panzetta. Finance Committee (to fill vacancies), Mr C. H. J. Avons, Dr L. Mullins.

The following recommendations of the Board were approved:

Admission to the Fellowship, A. Sundralingam. Admission to the Associateship, T. H. Rogers, Jun., G. L. H. Woodthorpe. Election to Long Service Membership, W. B. Wiegand. Licentiateship Equivalent, Swedish candidate, W. Bask.

Overseas Sections

A resolution put forward by members of the Institution in Ceylon at their meeting in Colombo on December 21 1959, seeking the approval of the Council to the establishment of a Ceylon Section was considered.

The Petition was received by the Council with great pleasure and in giving formal approval to the proposal the Council expressed their best wishes for a successful and progressive future and their particular thanks to Dr E. D. C. Baptiste, the chairman of the Provisional Committee and to Dr Sundralingam the prime mover in this development.

A resolution signed by 29 members of the Institution in Rhodesia seeking approval to the setting up of an IRI Section in the Federation of Rhodesia and Nyasaland to be known as the Rhodesian Section, was duly approved. A message of good wishes and thanks was sent to the chairman of the committee, Mr B. J. Strom of the Rhodesian Bata Shoe Company Ltd., Gwelo.

The Council was glad to learn from Mr L. S. Longhurst, honorary secretary of the New South Wales branch, that a membership recruiting drive is to be made in the New South Wales area. It was also noted that Mr G. N. M. Milne had been elected chairman of the Australasian Council for 1960 and of the New South Wales branch.

A letter from Mr L. Luckham, chairman of the Indian Council stating that the prospects for opening a branch in Bombay were good and if this were successfully accomplished another in Madras would be considered, was noted.

It was noted that a lecture under IRI auspices has been arranged for Monday February 22 1960, at the Imperial Hotel, Cork, when Mr E. Tompkins, B.Sc., A.I.R.I., Chief of Tyre Design, Fort Dunlop, will read a paper on 'Tyres and the Modern Car.'

Other Activities

The following items were brought to the notice of the Council:

Thanks to the action of the Dunlop Rubber Co. Ltd. in loaning the necessary plant and equipment and to the College in providing teaching facilities, practical instruction is now available at the Matthew Bolton College, Birmingham.

The Fifteenth Foundation Lecture will be delivered by Mr Maldwyn Jones, Development Director, Imperial Chemical Industries Ltd., Plastics Division, in the Library Theatre, Manchester, on Friday May 20 1960, and this will be followed by a dinner at the Midland Hotel.

Compounding Problems

NCRT COURSE

CHOICE of polymers and polymer blends, vulcanizing systems, plasticizers and softeners, fillers and other ingredients, were covered by Mr D. A. Smith in the first lecture, 'Compounding Rubbers for High Temperature Service,' of the current short course.

The lecture included a demonstration of the use of the recording thermobalance in an investigation of the thermal stability of butyl rubber. The demonstration was conducted in one of the college research laboratories and relayed to the audience in the main lecture theatre by means of closed circuit television.

Dr W. H. Jones (Volcrepe Ltd.), who gave the second lecture on 'Soft Rubbers and Cellulars,' outlined the general influence of curing systems and fillers on compound hardness and proceeded to illustrate his points by reference to specific mixings based on SBR, CR, IIR and Hypalon.

In reference to processing, difficulties in the use of peptizers, the unreliability of plasticity figures compared with handling experience (for NBR), the importance of grinding through a tight nip and the proper resting of compounds before addition of sulphur and accelerators, were all discussed. Mixing times might be very long (up to 60 minutes for lightly loaded stocks) but care at this stage resulted in a reduced reject rate on curing. Press curing, precautions and the avoidance of defects, were discussed. Expanded rubbers were mentioned with particular reference to microcellular materials and post-cure procedures intended to stabilize shrinkage.

The third lecture entitled 'High Performance Black Compounds,' was given by Mr N. C. H. Humphreys (R. W. Greeff and Co. Ltd.). After summarizing the main types of blacks and outlining their preparation, the lecturer discussed at length the significance of the term 'reinforcement' and drew attention to the work of Payne at RABRM on dynamic modulus as a criterion of reinforcement and to the great influence of crystallinity in polymers such as NR. Special emphasis was placed on the differences between the black requirements of natural rubber and the principal synthetics: SBR, O/E SBR, CR, NBR and IIR.

The lecture concluded with a summary of recent work on black reinforcement including reference to hysteresis and tread wear, the work of Mullins, *et al.*, on the mechanism of tear propagation, Wake's theory of adsorption forces between rubber and black particles and work on the stress-strain behaviour of black vulcanizates at very low elongations where the 'Mullins effect' becomes negligible.

A lively discussion touched particularly on the behaviour of black reinforced butyl and its prospects in tyres.

Mr A. S. Bishop, who retired from the chairmanship of Goodyear Tyre and Rubber on January 31, has been elected to the board of Caffyns Ltd., Eastbourne.

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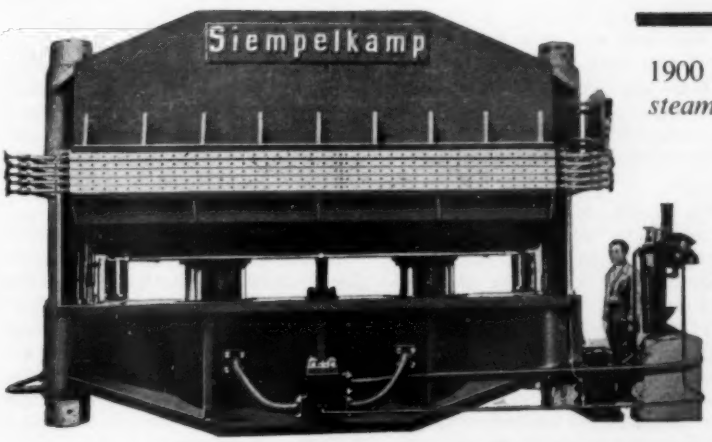

1900 ton 6-Daylight Press by Siempelkamp steam platens 12′ 6″ x 7′ 9″; two 25″ dia. rams, with self-contained Pump Unit.
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Steam Curing of Rubbers

A LABORATORY AUTOCLAVE

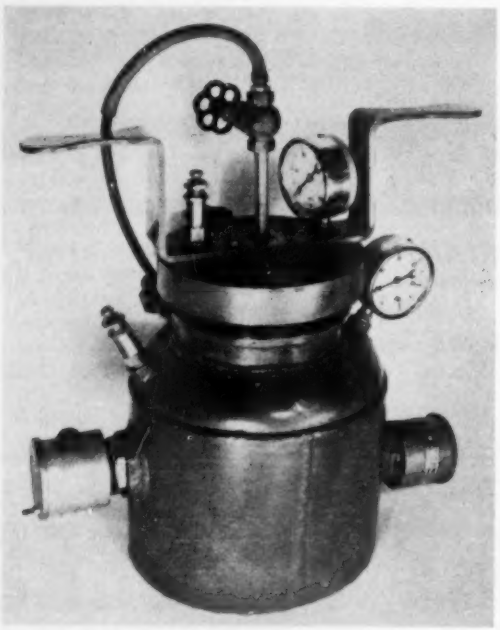
TO enable rubbers to be accurately steam cured on a laboratory scale a small autoclave was required by Joseph Lucas Research Laboratories, Birmingham. Enquiries showed that no suitable piece of equipment was available, and so one was designed by the laboratory to meet the following specifications:

1. A maximum operating pressure of 150 psi.
2. A quick means of loading and unloading.
3. A rapid means of applying and accurately maintaining the required steam pressure to the uncured rubber.
4. The required steam pressure should be capable of being raised in a short period of time.
5. The autoclave should be portable and small in size but capable of taking 4 x 4 x ¼in. rubber test sheets.

Two Pressure Vessels

The autoclave was designed with a self-contained steam supply and a separate curing chamber fitted with a quick release lid, as illustrated. The autoclave consists of two pressure vessels; the larger bottom one is used for generating steam by heating water with two electrical immersion heaters. The upper vessel contains the rubber samples to be cured, and is connected to the bottom container by a pipe fitted with a stopcock.

The bottom vessel is fitted with a pressure gauge reading to 200 psi, a safety valve set at 150 psi, and a filler plug. A 2 Kilowatt and a 1 Kilowatt immersion heater are let into alternate sides of the bottom vessel. The lid of the top vessel is fitted with a handle, a steam release valve, a pressure gauge reading to 200 psi and a safety valve set at 150 psi. The autoclave was pressure tested to 300 psi and given insurance approval. The body was constructed by Thomas Oldham Ltd., of Stockport, and the total cost, inclusive of valves, gauges and heaters was approximately £40.



This portable laboratory autoclave, designed by the Joseph Lucas (Gas Turbine Equipment) Research Laboratories, gives a rapid, accurate method of applying steam pressure to uncured rubber

Operation

The bottom vessel is filled with sufficient water (one gallon) to cover the top heater by 1in. The lid is lightly screwed down on the top vessel, so that it can heat up with the rest of the autoclave. All stopcocks are closed and both heaters switched on. When a pressure 20 psi higher than that required for curing the rubber is reached in the bottom vessel, the 2 Kilowatt heater is switched off. So as to clear the connecting pipes of residual water, a small amount of steam is passed through the upper vessel by releasing the stopcock in the connecting pipe and opening the steam release valve.

The rubber components to be cured are placed in the upper vessel, the lid tightly screwed down, the steam release valve shut and steam admitted until the required pressure is reached. This pressure can be held by adjusting the stopcock in the connecting pipe and bleeding a very small amount of steam through the release valve.

After the period of cure the stopcock in the connecting pipe is closed and the steam pressure in the top vessel released by opening the steam release valve. The lid is then unscrewed and the rubber components removed. The autoclave is ready for curing further components if necessary.

A pressure of 60 psi can be raised from cold in 20 minutes and 100 psi can be raised in 30 minutes. The pressure can be maintained to ± 1 psi and a component can be cured for a given period of time to ± 30 seconds. A refinement which is to be carried out on this autoclave is the fitting of a combined pressure gauge and relay with maximum and minimum contacts to the bottom vessel, so that the steam pressure can be set and controlled automatically.

DUNLOP FIRE

Mr Charles Watson, an assistant planner at Dunlop's Rochdale factory, is believed to have been killed while helping to fight last week's fire at the factory (*RJIP*, February 6). He was playing a hose on a wall when the ceiling collapsed, burying him in the debris. Mr Watson, who was in his early forties, was married with one child.

About 40% of the factory area has been affected by the fire and 150 workers are helping with the clearing up. On the day following the fire, full production had been resumed on the manufacturing side using mainly processed stocks. Work has started on dismantling machinery and strengthening damaged walls; a substantial part of the machinery will probably be salvaged.

Propylene Progress

A new phase of propylene utilization is now in full swing in I.C.I.'s Tees-side petroleum chemicals enterprise. Propylene oxide and propylene glycol are now in commercial production, and the commissioning of the new 'Propathene' plant in late 1960 will add a third new use for propylene.

These developments have been made possible by the recent extension of propylene capacity at Wilton to over 80,000 tons a year. I.C.I. has thus been able to implement plans not only for these new products, but also for making additional feedstock available for existing propylene derivatives, namely isopropyl alcohol, acetone, and normal- and iso-butanols.

Rubber Statistics

WORLD POSITION AT END OF NOVEMBER — 2

FROM details just published by the Secretariat of the International Rubber Study Group, it is now possible to estimate the position of the leading producing and consuming countries up to the end of November last. The following table, which is expressed in 1,000 long tons, shows the natural rubber production position during this period.

NATURAL PRODUCTION

	Jan.Nov. 1959	Jan.Nov. 1958
Malaya:		
Estates ..	370	349
Smallholdings	263	243
	— 633	— 592
Indonesia:		
Estates ..	196	217
Smallholdings	451	383
	— 647	— 600
Ceylon	79½	89
Thailand ..	159	131
Sarawak ..	41	34
Other British Borneo ..	23	18½
Liberia	38	38
India	21	21½
Vietnam ..	62	61
Cambodia ..	30	28½
Others	124	148½
	1,857½	1,762

It would appear from this table that, in spite of recent statements to the contrary, Indonesia is still just managing to maintain her lead over Malaya as the leading natural rubber producer, thanks to a very considerable increase in smallholder production. On the other hand, estate production in Indonesia has fallen somewhat, in marked contrast to estate production in Malaya, where, thanks to a vigorous replanting policy, production on estates is now beginning to rise. Smallholder production is also rising in Malaya, according to the published statistics, but not to the same extent, it would appear, as in Indonesia. Thailand is the only other country to show a really large increase, amounting to over 25,000 tons or some 20% in all.

The following table shows the natural rubber consumption position over this period.

NATURAL CONSUMPTION

	Jan.-Nov. 1959	Jan.-Nov. 1958
UK	164	159
USA	512	438
France	122	125
Western Germany ..	130	120
Remainder of Europe	432	427
Others	557½	526
	1,917½	1,795

The above table shows quite clearly the considerable change which has taken place in the USA picture after last year's slump, the consumption figure rising by some 75,000 tons or about 18%. In the case of other manufacturing countries, the rise if any—in the case of France there has been a slight fall—has been slight in comparison with the increase in synthetic rubber consumption, due to the opening up of new plants in the consuming countries. This is apparent from the next table.

SYNTHETIC CONSUMPTION

	Jan.-Nov. 1959	Jan.-Nov. 1958
UK	70	56½
USA	982	794
France	60	50
Western Germany ..	62	50
Rest of Europe ..	82	58
Others	169	121½
	1,425	1,130

The increase in synthetic rubber consumption in the USA of 188,000 tons, compares with an increase in natural rubber consumption of 74,000; in the UK figures are 13,500 and 5,000 respectively, in France 10,000 and a minus quantity of 3,000, and in Western Germany 12,000 and 10,000.

Self-curing Compound

A latex compound for carpet backing, described as self-curing and as having exceptional heat and light-ageing characteristics, has been developed by the Naugatuck Chemical Division, United States Rubber Co.

The new material, Lotol L-4634, can be cured by merely drying, thus making high temperature curing unnecessary. The compound contains neither the usual sulphur curing agents nor accelerators. Used with ordinary fillers, it is said to give a high-strength, full-bodied hand with good resilience and resistance to deformation.

Leonard F. Wailing has been appointed to the board of Barrow Hepburn and Vale Ltd. He has been with the company for 34 years, and secretary for 27.

Book Reviews

GUMMI-ADRESSBUCH 1959-1960 (Curt R. Vincentz Verlag, Hannover. 608 pp. DM32).*

The third edition of this well-known directory of the German rubber industry has recently been published. The useful place index, listing rubber manufacturers, wholesalers, retailers and dealers, in districts from Aachen to Zweibrücken, and the company name index have been brought up to date and enlarged. Details of activities are given in most cases.

The product name and trade mark section, a comprehensive one, is subdivided into parts dealing with raw, semi-finished and finished products, and with machines, equipment, testing apparatus and accessories. There is a separate section covering manufacturers of machines and equipment for the rubber and plastics industries.

* *Obtainable from 'Rubber Journal and International Plastics' Book Department, price £3 4s.*

EUROPEAN PLASTICS. (Bureau voor Bedrijfsdocumentatie — Economic Documentation Office—Hilversum, 136 pp. £1 5s. US $3.50.)

The first edition of 'European Plastics' has recently been published. It is a directory, based on the product classification system, giving a survey of the production programmes of manufacturers (in 13 European countries) in the field of raw materials, unfinished goods and auxiliary materials for the plastics industry.

The production programmes of about 700 manufacturers in 13 European countries are given, classified under some 90 headings and sub-divisions. These include cellulosics, urea formaldehyde resins, casein plastics, epoxy resins, phenolics, polythene, polyamides, polyesters, acrylics, polystyrene, PTFE, polyurethanes, vinyls, silicones and alkyd resins. There are also sections for plasticizers, stabilizers, pigments, fillers, etc.

A volume of this size, covering such a wide field, cannot hope to be comprehensive but within its limits it is extremely useful and of undoubted value. The text is in English and there are indexes in English, French, German, Italian and Spanish.

* Copies may be ordered through the Books Department, RUBBER JOURNAL AND INTERNATIONAL PLASTICS, Maclaren House, 131 Great Suffolk Street, London, S.E.1.

Polyethylene Processing

Published in Japan, and in Japanese, *Polyethylene Processing*, by I. Ohno, chief of the machinery department of the Chugai Boyeki Co. Ltd., Tokyo, and a member of the Society of Plastics Engineers, describes the history and development of polythene and its characteristics. There are chapters on moulding and processing techniques, including tubular film extrusion, lamination, sealing, vacuum forming, pipe extrusion, wire and cable covering, and injection, compression and blow moulding techniques. There are more than 200 illustrations and a number of drawings and diagrams.

PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

Machine for Forming Sheet Rubber into Rolls or Dollies

No. 821,933. Dunlop Rubber Co. Ltd. Inventor: T. A. Lamb. Application, April 16 1955. Filed, March 1 1956. Published, October 14 1959.

The machine is for cutting a length of masticated or compounded sheet rubber into strips and subsequently rolling the strips into rolls or, as they are generally termed, dollies. Fig. 1 is a perspective view of the machine, Fig. 2 is a view in cross-section of a part of the machine, and Figs. 3 to 9 illustrate the operation of the machine.

As shown in Fig. 1, the machine comprises a pair of conveyor belts 1 supported on a pair of drums 2 mounted one at either end of a rigid framework 5. The drums are driven by an electric motor operating through a chain sprocket 3 and chains 4. Shearing members 6, 7 and 8 (see also Fig. 2) are rigidly attached to the chains 4, extend laterally of the conveyor surface 9 and project outwardly therefrom. Each of the shearing members has a shearing edge 10 and a face 12 nearest the input end of the conveyor, this face having serrations 12a which serve to resist the tendency of rubber in contact with the surface to slip. A further shearing member 13, adapted to co-operate with the shearing members 6, 7 and 8, is supported by arms 14 each of which is mounted on a pivot 15 rigidly attached to the machine frame. A shearing edge 16 on the shearing member 13 co-operates with the shearing edge 10. Skids 17 are attached one adjacent to each end of the shearing member 13 (Fig. 2), each of the skids having an outwardly-curved leading edge 18 which locates with the surfaces 11a or 11b formed on the shearing members 6, 7 or 8, should these shearing members move out of position during the operation of the machine, for example, by flapping of the conveyor belts and chains.

A face 21 is formed on the shearing member 13, the leading portion of a length of rubber being adapted to be conveyed into abutting relationship with the face 21 whereby it is turned outwardly relative to the conveyor surface 9 as described below. A plate 22 is rigidly attached to the shearing member 13 and has a face 23 which constrains the outward movement of the outwardly-turned portion of the rubber sheet to facilitate the formation of a dolly. A rolling member 24 in the form of a rigid steel sheet is pivotally attached at its leading end to arms 25, each of which is rigidly attached to a common shaft 26 rotatably mounted in bearings 27. The end 28 of the rolling member 24 has a supporting rod 29 rigidly attached to it, this rod projecting from each side of the rolling member and being supported on each side of the machine frame by brackets 30. These brackets are provided with a surface 31 along which the ends of the rod 29 may slide during pivotal movement of the rolling member 24 on the arms 25.

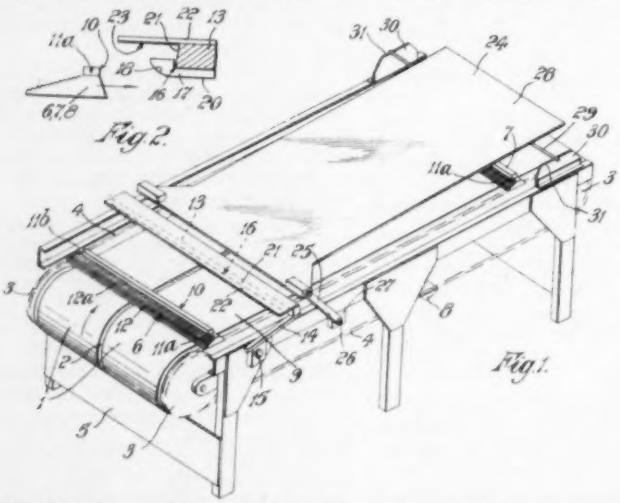


Fig. 1.

Fig. 2.

The distance between the rolling member 24 and the conveyor surface 9 increases gradually from the input to the output end of the rolling member 24.

In operation of the machine, sheet rubber passes over a shearing member 6, 7 or 8 and is carried on the surfaces of the conveyor belts towards the shearing member 13. As shown in Fig. 3, when the shearing member 6 is conveyed into a position adjacent to the shearing member 13, the shearing edges 10 and 16 co-operate to shear a length of rubber 32 from the rubber sheet 33, the length 32 being simultaneously rolled into the form of a dolly as described below. The leading portion 34 of the rubber sheet (Fig. 4) is conveyed on the conveyor belt so that the face 34a abuts the face 21 of the shearing member 13, the leading portion 34 being turned outwardly relative to the conveyor surface 9. The tendency of the rubber to slip, during this turning movement, on the rearward face 12 of the shearing member 6 is resisted by the serrations 12a. Further movement of the rubber sheet 33 causes the outwardly-turned leading portion of the rubber to be rolled back (Figs. 5 and 6), the conveying movement of the rubber causing the rolled-back leading portion of the rubber to contact the shearing member 13 (Fig. 6) which swings about the pivot 15 and moves outwardly as indicated by the arrows in Fig. 6 so that the rolled-back leading portion of the rubber sheet 33 may be conveyed past the shearing member 13 into frictional contact with the rolling member 24 (Fig. 7).

It will be noted, with reference to Figs. 6 and 7, that the thickness of the rolled leading portion of the rubber is such as to cause the rolling member 24 to move outwardly relative to the conveyor surface. The outward movement is restrained by the pivot arms 25 which cause the rolling member 24 to move rearwardly so that the rod 29 slides on the surfaces 31 formed on the brackets 30. This movement ensures that the rolling member 24 will frictionally contact the rolled-back portion of the rubber despite the fact that this portion may vary in thickness. Further movement of the rubber carried by the conveyor causes it to roll upon the rolling member 24 to form a dolly (Figs. 8 and 9), the required length being sheared from the sheet 33 by the co-operation of the shearing edges 10 and 16 as described above. The formed dolly rolls off the end of the conveyor, the operation of the machine being continuous.

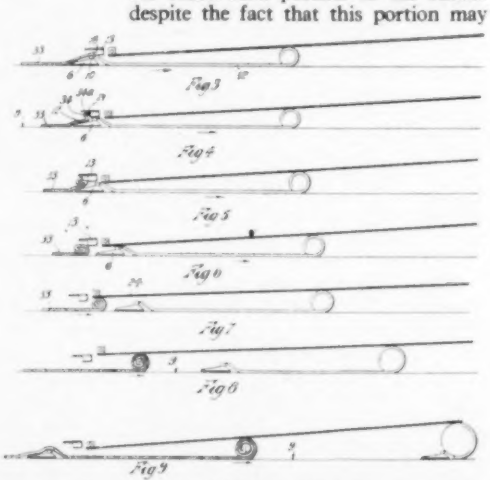


Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Rubber and Plastics Stock Market

A REVIEW OF PRICES AND TRENDS

INACTIVE, uninteresting, hesitant, cautious, subdued. All these words have had a good going over during the past few weeks by financial commentators. We need only add that there has been a most notable slow-down in stock market activity, and share prices have had their quietest time since the election.

The tone, however, has remained reasonably steady and up until now selling quite light, but there appears to be a growing opinion in important investment circles that the market is set for some form of correction. So far, any downward tendency has been resisted, and at the moment there is little on the horizon to suggest that this will not continue to be the case—over the short term at least.

This is certainly not the time to sell top-class shares which offer the best growth potential.

One barometer worth watching over the months that lie ahead will, we think, be the Dow Jones industrial share index which registers price movements on the Wall Street Exchange. Since the turn of the year it has put in a disappointing display, and those who have close American connexions still remain cautious about forecasting the outlook.

Labour troubles have also proved a restraining influence, while the Chancellor of the Exchequer's campaign for lower prices has acted as a further dampener.

Plastics favourites like BAKELITE, BRITISH XYLONITE, DE LA RUE, BRITISH INDUSTRIAL PLASTICS and O. AND M. KLEEMANN, improved following further investment support. Among the top-line industrials, DISTILLERS, COURTAULDS, ENGLISH CHINA CLAY and TURNER AND NEWALL have all made fresh headway.

PLASTIC ENGINEERS, whose shares have a Cardiff quote, announced a 7½% rise in its dividend to 22½%. The directors are also handing round free shares on a 2 for 5 basis, and expect to maintain the 22½% next time on the increased capital. An upsurge of activity last year took profits up to a record of £87,000 before tax.

Since becoming a public company five years ago, the company has suffered some ups and downs, but now seems to be more firmly established and moving ahead—well in line with the trend of industry. Its products are mainly precision mouldings in nylon, plastics packaging and containers, nylon filters and extruded rod and general injection mouldings. The directors also forecast that profits for 1960 should at least be maintained at about the present level.

Earlier this month ALBRIGHT AND WILSON sent their formal offer to shareholders of A. BOAKE ROBERTS AND CO. (HOLDING). With it went the unanimous recommendation for acceptance by the BR directors. There is also an up-to-date trading report from Albright and Wilson which revealed that results showed an improvement

Continued on page 256

Share Price Movements

Par Value	Company	1959-60 High	Low	Jan. 30	Latest
£1	A.E. Ind. Ord.	67/6	53/9	63/3	64/-
5/-	Albright & W. Ord.	31/-	13/4½	26/6	28/-
£1	" " " 5% Pref.	18/9	15/4½	16/6	16/3
5/-	Anchor Chemical Ord.	27/6	10/3	22/6	24/6
5/-	Andersons Rub. Ord.	4/6	1/1½	3/1½	3/1½
£1	Angus Geo. Ord.	44/6	25/3	38/9	43/9
5/-	Ault & Wiborg Ord.	24/-	11/6	20/6	21/9
£1	Avon India Rubber Ord.	47/6	35/6	40/-	41/3
£1	" " " 6% Pref.	18/6	16/6	18/3	17/6
10/-	Bakelite Ord.	46/3	22/-	42/6	45/6
£1	" 6% Pref.	19/6	17/6	18/3	18/3
£1	Baker Perkins Ord.	53/9	41/3	53/9	51/6
4/-	Bank Bdg. Rubber Ord.	3/7½	1/6	3/1½	3/6
5/-	Boake (A) Roberts Ord.	29/6	12/3	23/9	29/-
£1	" " " 5% Pref.	16/9	13/9	15/-	16/3
4/-	Brammer H. Ord.	17/6	9/6	17/3	17/6
10/-	Bridge, David Ord.	58/-	24/3	57/6	57/6
5/-	Bright, John Ord.	18/9	9/6	17/6	17/9
2/-	Brit. Ind. Plas. Ord.	13/6	6/9	12/4½	13/1½
2/-	" 10% (tax free) Pref.	4/9	3/-	4/3	4/9
£1	British Xylonite Ord.	87/6	46/-	83/9	84/-
£1	" " 5% Pref.	16/9	15/-	16/9	16/9
£1	BICC Ord.	61/-	44/6	57/6	57/9
5/-	BTR Ind. Ord.	13/3	8/1½	10/7½	12/-
£1	" " 7½% Pref.	24/3	20/9	23/3	23/9
£1	Courtaulds Ord.	67/9	20/-	60/3	62/3
£1	" 5% 1st Pref.	18/9	15/7½	17/3	17/3
£1	" 6% 2nd Pref.	22/6	19/-	20/3	20/6
4/-	Cow, P. B. Ord.	7/6	6/6	7/-	7/1½
£1	" " 5% Pref.	15/6	12/6	15/6	15/6
1/-	Dannimac Mfg. Ord.	11/6	5/2	7/3	11/6
10/-	De La Rue Ord.	73/9	42/9	69/-	70/-
£1	" " " 3½% Pref.	12/9	10/6	12/-	11/10½
10/-	Distillers Co. Ord.	39/6	23/6	36/-	36/6
£1	" " 6% Pref.	23/-	19/6	21/3	21/6
£100	" 5% Conv. Loan	£97	£92	£94½	£95½
£100	" 5½% Unsec. Loan	£98½	£90	£94½	£94
10/-	Dunlop Rubber Ord.	29/9	17/-	26/-	25/-
£1	" " 5½% Pref.	20/3	16/3	18/3	18/3
£100	" 3½% 1st Debs.	£78	£71½	£75½	£77½
£100	" 4½% 2nd Debs.	£88	£80½	£86	£86
£1	Eng. Elect. Ord.	61/-	37/9	46/3	47/-
4/-	Ebonite Cont. Ord.	15/3	11/-	13/-	13/10½
£1	English China Clays Ord.	94/3	47/-	87/6	91/-
£1	Goodyear Tyre 4% Pref.	13/-	11/9	12/4½	12/6
5/-	Greeff Chem. Ord.	31/9	15/-	30/3	30/-
10/-	Greeff Chem. 5½% Pref.	8/9	7/6	8/7½	8/6
5/-	Hackbridge Hldg.	19/9	14/-	16/3	16/-
4/-	Greengate & Irwell Ord.	7/-	4/-	5/9	5/9
£1	Harrisons & Crosfield Dd.	64/-	30/9	57/3†	57/-
1/-	Hunt & Moscrop Ord.	2/6	1/1½	2/3	2/1½
£1	Imp. Chem. Ord.	62/6	32/9	59/4½	58/6
£1	" " 5% Pref.	19/-	15/6	17/4½	17/7½
£100	" 4½% Unsec. Loan	£90½	£84	£87	£87
£100	" 5½% Conv. Loan	£196½	£180	£182	£180
1/-	Kleemann (O. & M.) Ord.	10/3	4/3	8/9	9/4½
£1	" " 6½% Pref.	19/-	14/-	17/6	18/3
2/-	Lacrinoid Prod. Ord.	4/3	1/5½	4/-	4/-
5/-	Laporte Ind. Ord.	31/-	19/3	28/-	27/4½
£1	" " 7½% Pref.	24/3	21/10½	23/9	23/9
£1	Leyland & Birm. Rubber Ord.	59/-	39/9	54/6	52/-
£1	" " " 6% Pref.	19/-	17/-	18/-	17/6
2/-	London Rubber	14/9	6/3	13/3*	13/-
£1	" 6% Red. Cum. Pref.	20/-	16/3	18/9	18/9
£1	McKechnie Bros. Ord.	71/3	39/3	68/9	68/9
£1	" " 'A' Ord.	67/6	38/9	67/-	66/-
£1	" " 6% Cum. Pref.	17/-	16/-	17/-*	17/-
5/-	Monsanto Chem. Ord.	27/9	14/9	24/3	24/1½
£1	" " 3½% Pref.	13/6	12/-	12/3	12/6
£100	" " 6% Debs.	£104½	£101	£103½	£103½
£1	North British Rubber	21/3	15/7½	21/-	20/6
5/-	Plastic Enginrs. Ord.	—	—	20/6	26/3
5/-	Redfern Holdings Ord.	7/-	2/6	5/-	4/9
2/-	RFD Ltd. Ord.	6/9	4/-	5/7½	5/9
£1	" " 5½% Pref.	16/6	12/-	16/3	16/3
2/-	Rubber Imp. Ord.	10/9	4/-	6/4½	6/6
2/-	" " 'A' Ord.	10/3	3/6	5/4½	5/6
£1	" " 5% 1st Pref.	13/3	10/-	13/3	13/3
5/-	Rubber Reg. Ord.	19/-	10/-	18/-	18/3
4/-	Shaw Francis Ord.	25/-	13/6	23/9	23/9
2/-	Silentbloc Ord.	13/-	7/6	11/9	11/6
2/-	Sussex Rubber Ord.	2/1	1/3	1/7½	1/7½
5/-	Sutcliffe Speak Ord.	13/-	6/3	12/6	12/6
£1	Turner & Newall Ord.	112/6	68/6	106/6	110/3
£1	" " " 7% Pref.	25/6	22/6	24/3	24/3
5/-	Universal Asbestos Ord.	43/-	14/3	36/3	42/9
5/-	Viscose Dev. Ord.	13/9	9/-	13/9	13/9
5/-	Warne William (Holdgs.) Ord.	19/3	10/9	17/6	18/3

*Ex-dividend †Ex-capitalization

Rubber Markets

LONDON

A generally uncertain and dull trend has prevailed in the London rubber market during the past week. Interest has been at a low level and business small. Distant positions record only small declines but the Spot and near positions are appreciably lower. Spot is over 2d. per lb. down at 33½d. nominal.

Latest prices are as follows:

No. 1 RSS Spot: 33½d. nominal.

Settlement House:

March 32⅞d.-33⅛d.

April/June 32⅝d.-32⅞d.

July/September 31⅞d.-32⅛d.

October/December 31⅜d.-31⅝d.

No. 1 RSS cif basis ports:

February 32⅞d.-33⅛d.

March 32⅞d.-33⅛d.

Godown:

February 114 Straits cents nominal.

LATEX

Centrifuged latex per gallon in drums, February, March, seller 20s. 2d., April-June 20s., cif European ports. Spot, 20s. 6d. Bulk, 19s. 6d. Creamed, seller, February, March, 19s. 8d. Normal, seller, February, March, 15s. 5d.

AMSTERDAM

The Amsterdam rubber market ruled as follows on February 8:

	Guilders per kilo	
No. 1 RMA	Feb. 8	Previous
February	3.24	3.24
March	3.22	3.22
April	3.17	3.17
May	3.17	3.17
June	3.17	3.17
April/June	3.12½	3.17

Sales: 15. Tendency: Quiet.

DJAKARTA

The market was very quiet due to the complete lack of interest on the part of buyers. Sheet No. 1 for ready delivery was 1½ rupiahs below last Friday's final level at 54½ rupiahs per kilo buyers.

	Rupiahs per kilo	
	Feb. 9	Prev.
Spot No. 1 Priok ..	54.50b	55.75n
Spot No. 2 Priok ..	53.50b	54.75n
Spot No. 3 Priok ..	52.50b	53.75n
No. 1 fine pale crepe, spot	52.00b	53.50b

Tendency: Very quiet.

SINGAPORE

After opening easy on disappointing overseas advices on February 8 the market became quiet. The publication of the January Malayan export figure at 101,452 tons stimulated prices mildly but at the higher levels sellers came out and prices reverted to opening levels. Lowers were more freely offered than of late. In the afternoon, prices eased slightly on some small up-country liquidation. February and March were switched in some quantity. Lower sheets were in good demand and sellers were more inclined to meet the market. Factories were quiet. After hours, the market was quiet.

	Straits cents per lb., fob Malayan ports to open ports	
	Feb. 8	Previous Close
No. 1 RSS Feb.	111⅜–111⅞	113½–113⅝
Mar.	111⅞–112	113⅛–113⅜
No. 2 RSS, Feb.	111⅛–111⅜	113 –113¼
No. 3 RSS, Feb.	111 –111⅛	112⅝–113
No. 4 RSS, Feb.	110 –111	112⅛–112⅜
No. 5 RSS, Feb.	108 –109	109⅜–110⅛
No. 1 Spot ..	111⅝–112	113⅜–113¾
No. 3 blanket thick remilled, Feb.... ..	109½–111½	111½–113½
No. 1 fine pale crepe, Feb. ..	128½–130½	130½–132½
2X thin brown crepe, Feb. ..	109 –110	111 –112

Tendency: Quiet

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rectangular drums fob at 198.80d. per gallon.

NEW YORK

The New York rubber market ruled as follows on February 8:

DEALERS' PRICES

	US cents per lb. ex dock	
	Feb. 8	Previous
No. 1 RSS, Feb.	38½n	39a
Mar.	38½b–38½a	38½b–38⅞a
No. 2 RSS, Feb.	38⅜n	38⅞a
Mar.	38½b–38⅜a	38⅜b–38½a
No. 3 RSS, Feb.	38⅛n	38⅜a
Mar.	38b–38⅛a	38⅛b–38⅛a
No. 1 RSS, Spot	38⅛n	39a
No. 3 amber blanket crepe, April	38⅛n	38½n
No. 1 latex thin crepe, Feb. ..	42⅞n	43⅛b
No. 1 latex thick crepe, Feb. ..	42⅛n	43n

FUTURES—REX CONTRACT

	Close	Prev. Close
March ..	38.35–38.41t	38.85t
May ..	37.60–37.65t	38.10–38.14t
July ..	37.20b–37.30a	37.60t
Sept. ..	36.70b–36.75a	37.05b–37.25a
Nov. ..	36.30b–36.50a	36.50b–36.70a
Jan. ..	35.80n	35.90b–36.10a
March ..	35.40n	35.60b–35.80a

Sales: 106. Tendency: Easy.

Rubber futures were softer on liquidation in a moderate trading volume on February 8. Traders said that slow buying interest in physicals here and lower foreign markets induced the selling. Factories prices ideas were substantially below the price of the rubber offered, according to traders. In the closing stages, futures were easy on scattered selling.

BANGKOK

No. 1 RSS

The price of No. 1 RSS at Bangkok on February 8 was 36.25 (36.50) US cents per lb.

CEYLON

No. 1 RSS

The price of No. 1 RSS spot at Colombo on February 8 was 128 (131) Ceylon cents per lb.

REINFORCED PLASTICS CONFERENCE

British Venue for 2nd International

THE British Plastics Federation, which organized Europe's first International Reinforced Plastics Conference at Brighton in October 1958, announces that it will hold a second one in England, at a place to be announced later, from November 30 to December 2 1960. The Conference will be entitled 'Reinforced Plastics—Problems, Practice, Prospects.'

An official of the Federation said, 'The first international conference was evidently greatly appreciated by all concerned in this forward-looking section of the plastics industry. The papers read then are still being widely quoted, but techniques have been developed and uses expanded so much since then that we have decided to call another meeting.

'An outline of the programme will be announced later and we shall then invite applications from delegates.'

IRI Golfing Society

A change has been made in the 1960 programme of the London section of the IRI Golfing Society. The Spring weekend meeting at Highwoods Golf Club has been moved from March 19 and 20 to March 26 and 27.

STOCK MARKET

Continued from page 255

over the August 1959 forecast and profits before tax for the second half of 1959 are now estimated to be well above those of the first half of the year.

Group profits of Boake Roberts before tax for the half year ended 1960 are expected to be substantially better than those for the previous half year. If the offer for the ordinary stock becomes unconditional Mr F. G. Pentecost, the chairman of Boake Roberts, will be invited to join the board of the new 'parent.'

Industry INTELLIGENCE

Technical Data

Polysar Krylene 602

Polysar Krylene 602, a 'cold' SBR, has recently been added to the range of Polysar rubbers. It is similar to Polysar Krylene NS except that it has a raw polymer Mooney viscosity about 20 points lower. The characteristics and applications of Polysar Krylene 602 are described in Polysar Technical Report No. 8:10B, by L. A. Bustos, distributed in the UK by Polymer (UK) Ltd., Walbrook House, Walbrook, London, E.C.4.

The low raw polymer viscosity of Polysar Krylene 602 produces the following effects: (1) Elimination or substantial reduction of peptizer and peptization times. (2) Greater and more uniform expansion of open-cell and closed-cell articles. (3) Faster extrusion rates. (4) Slightly lower modulus and hardness. Because of these features, Polysar Krylene 602 will be useful for compounds which normally require a long period of breakdown, such as expanded and sponge rubber, extruded articles, spreading cements for fabric proofing and direct vulcanization soling compounds. Mixes are given for weatherstrip and for expanded soling based on Polysar Krylene 602, together with data for the physical properties of the vulcanizates, corresponding data for Polysar Krylene NS being included for comparison. In its non-staining and non-discolouring characteristics, Polysar Krylene 602 is as good as Polysar Krylene NS, as shown by test results in the report.

Safe Handling of Organic Isocyanates

Certain organic isocyanates have assumed great importance in a variety of industrial applications, including the manufacture of polyurethane foams, printers' rollers, lacquers and synthetic rubbers. Organic isocyanates as a class require care in handling but certain of them produce a toxic vapour, and these require special care. Instructions primarily intended to cover the safe handling of products in the latter group have been issued as Urethane Chemicals Literature No. 2 by Imperial Chemical Industries Ltd., Dyestuffs Division. The isocyanates covered include Suprasecs SF, SFN, E, EN, C and AC.

The basic principles for the correct handling of isocyanates are as follows: (1) Avoid breathing the vapour. (2) Avoid contamination. (3) Avoid spillages. (4) Decontaminate immediately when necessary. (5) Work tidily and carefully. (6) Use air-hoods in case of emergency. These principles are discussed in detail. Supplies of liquid decontaminant, solid decontaminant and dilute ammonia made according to recipes given in the booklet must be readily available whenever isocyanates are being handled. Following even heavy exposure to isocyanate vapours, no permanent damage to the lungs is sustained and recovery is rapid and complete. However, if the recommended precautions and sensible procedure are adopted, no worker handling isocyanates will be affected by the vapours in any way.

Cellobond Rubber Reinforcing Resins

Cellobond rubber reinforcing resins are a group of phenolic resins specially developed for reinforcing natural and synthetic rubbers. They harden under the influence of heat in the presence of aldehyde donors such as hexamine, though in the uncured state they exhibit thermoplastic characteristics. A detailed survey of the use of these resins in various rubbers has been issued as Technical Manual No. 11, a 100-page bound book, by British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1.

Cellobond reinforcing resins may be mixed with natural rubber, nitrile rubber, neoprene and SBR, and the book contains extensive data for the physical properties of vulcanizates of these rubbers containing various proportions of the resins. Because of their thermoplastic nature in the uncured state, Cellobond resins function as processing aids during the compounding and subsequent moulding of the rubber yet they enhance the stiffness of the cured product. They eventually form an integral part of the binder system and are thus superior to conventional processing aids and plasticizers. This advantage is most marked when they are used in nitrile rubber with which they behave as true reinforcing agents. With this type of rubber, products over a useful range of hardness and tensile strength may be obtained in the absence of fillers, a point of great importance in the manufacture of hard products of low density. A section of the book is devoted to the use of Cellobond reinforcing resins in various rubber products, namely, general moulded mechanicals, extrusions, hose, belting, footwear, trolley wheels and castors, electrical products, sponge rubber, tyres, oil seals, battery boxes and roller coverings. Typical formulations for most of these products are included.

New Publications

Carbon Black

A further issue of *Carbon Black Abstracts* has been published by Cabot Inc., 125 High Street, Boston, Mass. This issue (Vol. 8, No. 3) contains sections on processing and production, and abstracts of applications, including applications of rubber blacks, and of carbon black in plastics and synthetic resins. The abstracts, which quote brief details and sources of reports and papers published throughout the world, also deal with economics and statistics.

Polymerization Accelerators for Unsaturated Polyester Resins

Three types of polymerization accelerators for use in conjunction with peroxide catalysts for curing unsaturated polyester resins are supplied by Novadel Ltd. The accelerators are of the cobalt, tertiary amine and mercaptan types and details of their composition, properties, application and dosage are given in an 8-page booklet issued by Novadel Ltd., Lucidol Products Division, St. Ann's Crescent, London, S.W.18.

Machines, Materials and Equipment

Wohler Foam Tester

The Wohler Foam Tester (US Patent 2,913,899) is a portable instrument for determining the compression modulus or firmness of all types of flexible foams as well as rubberized hair. The standard model can be used for testing foam products from 2 to 6in. thick,

while by special order, the instrument can be modified to extend the range from 1 to 9in. foam thickness. On cored foam, the tester operates through a tiny, non-damaging incision in the top slab, while on uncored material, a 12 x 12in. test sample is plugged with a small hole to achieve the same result.

The Wohler Foam Tester as shipped comprises a 50 sq. in. compression foot and stem, graduated scales for indicating foam height and deflection, ten plated steel weights ranging from ½ to 10lb., scalpel and instruction sheet, all contained in a carrying case. In addition to the compression modulus test, the instrument may be used for measuring other properties of foam such as (1) compression set under constant load, (2) change in deflection under constant load, (3) hysteresis, and (4) change in compression at low temperature. The Wohler Foam Tester is made by the Browning Instrument Co., P.O. Box 152, Bath, Ohio, USA, and the price is $189.50.

Future Events

INSTITUTION OF THE RUBBER INDUSTRY

Manchester Section.—Monday February 22 at the Engineer's Club, Manchester, at 6.45 p.m. 'Towards the Quantitative Understanding of Rubbers' by Professor G. Gee, C.B.E., F.R.S. (University of Manchester).

Merseyside Section.—Monday February 22 at the Exchange Hotel, Liverpool, at 7.15 p.m. 'Problems of the Rubber Industry.' Panel of speakers: Dr W. F. Watson (RABRM), R. C. Davies, F.I.R.I., J. D. Crabbe (Dunlop) and J. H. Carrington, B.Sc., F.R.I.C., F.I.R.I. (Anchor Chemical Co.).

PLASTICS INSTITUTE

Midlands Section.—Friday February 19 at the James Watt Memorial Institute, Great Charles Street, Birmingham 3, at 6.30 p.m. 'Polyacetal Resin,' by G. Barrett (Dupont Co. (UK) Ltd.).

Scottish Section.—Wednesday February 17 at the North British Hotel, Edinburgh, at 7.30 p.m. 'Plastics and Rubber in the United States,' by G. H. Madge (North British Rubber Co. Ltd.).

North-Eastern Section.—Wednesday February 17 at the Eldon Grill, Grey Street, Newcastle, at 7 p.m. 'Melamine Resins' by a chemist from Formica Ltd.

Western Section.—Wednesday February 17 at Gloucester Technical College at 7 p.m. 'The New Plastics: Recent Developments in Materials,' by C. W. Welch (*Plastics*).

IRI Manchester Golfing Society

The Manchester Section's Programme for 1960 is as follows: Wallwork Cup Qualifying Round: April 25, Ringway Golf Club; Wallwork Cup Final: May 28, 29, 30, Aldeburgh; Manchester Challenge Cup and Invitation Day: June 20, Prestbury; Captain's Prize Competition: July 18, Romiley Golf Club; Bridge Trophy: September 12, Manchester Golf Club, Hopwood; Autumn Trophy: October 3, Royal Lytham and St. Anne's Golf Club.

Hon. secretary of the Manchester Section is G. C. Swann, British Recovered Rubber and Chemical Company, Ltd., Ashton New Road, Clayton, Manchester, 11. Tel. EASt 1406.

A reinforced plastics light buoy, manufactured by the Gas Accumulator Co., Brentford, was laid last week by Trinity House in the North Sea, off Harwich.

Mr T. B. McLaren has been appointed superintendent of the Shell Chemical Company's Stanlow, Essex, chemical plant.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

DURACOUR (793,166) Leather cloth, imitation leather cloth, oil cloth and imitation oil cloth, all for use as wall-hangings; and imitation leather cloth and imitation oil cloth; all being coated with plastics. Courtaulds Ltd., 16 St. Martin's-le-Grand, London, E.C.1. To be Associated with No. 781,418 (4203, 118) and another. (Class 27; December 23 1959).

PANG (789,584) Rubber adhesives included in Class 1; rubber cements, rubber solutions and vulcanizing preparations. Pang Chemical Vulcanizers Ltd., Imperial House, Dominion Street, London, E.C.2. To be Associated with No. 789,588 (4243, 1388) and others. (Class 1; December 30 1959).

FLINTKOTE

B789,663. Bituminous and rubber adhesives for use in industry. The Flintkote Co., 30 Rockefeller Plaza, New York, USA. Address for service is c/o Stevens, Langner, Parry and Rollison, 5 to 9 Quality Court, Chancery Lane, London, W.C.2. To be Associated with No. B694,020 (3895, 42) and others. (Class 1; December 30 1959).

NONOX (795,228) Chemical substances included in Class 1 used in the manufacture of natural and synthetic rubbers and of plastics to prevent oxidation. Imperial Chemical Industries Ltd., Imperial Chemical House, Millbank, London, S.W.1. To be Associated with No. 474,755 (2552, 328) and another. (Class 1; December 30 1959).

MAXYMIT (787,592) Insulating gloves, bottling gloves, and gloves for industrial use (other than for protection against accident or injury). Maxwell Plastics Ltd., 147 Orford Road, Walthamstow, London, E.17. To be Associated with No. 787,591 (4243, 1384) and another. (Class 17; December 30 1959).

NEW COMPANIES

Cisterns, Ltd. (646,784).—January 12. Capital: £2,000 in £1 shares. To carry on the business of manufacturers of sanitary equipment, plastic and metal moulders, steel fabricators, etc. The first directors are to be appointed by the subscribers. Solicitors: Simson Curtis and Co., Leeds, 1.

Initial Plastics Industries Ltd. (647,631).—January 21. Capital: £100 in £1 shares. Herbert F. Whitmarsh, 2 Belimont, N.W.3, is first director. Regd. office: 109 Jermyn Street, S.W.1.

Direct Tyre Sales (Plymouth) Ltd. (647,736).—January 22. Capital: £100 in £1 shares. Frederick C. Chambre, 50 Lynwood Avenue, Woodford, Plympton, S. Devon is the first director. Regd. office: 87 Union Street, Stonehouse, Plymouth.

Firmaglass Ltd. (647,740).—January 22. Capital: £100 in £1 shares. To carry on the business of sales promotion specialists, manufacturers' agents, manufacturers of and dealers in laminated fibre glass, etc. Directors are: William J. R. Payne, (chairman), 86 Sydney Street, S.W.3; Robert C. Payne, 35 Redesdale Street, S.W.3; Anthony A. F. M. O'Ferrall and Brian D. Firmager. Regd. office: 6, 8 and 10 Priory Mews, Priory Grove, S.W.8.

Maidenhead Plastics Ltd. (647,696).—January 22. Capital: £100 in £1 shares. To carry on the business of manufacturers, extruders and moulders of and dealers in plastics, etc. The directors are: Norman Gibbs, 9 West Point, Cippenham, Bucks.; Bikram Singh Dhillon, 20 Burlington Avenue, Slough, Bucks.; Santokh Singh Bahgar, Pritam Singh Nimba and Mrs. Ivy C. K. Stevens. Regd. office: Liberal Club Buildings, The Acre (Victoria Street), Windsor, Berks.

Wavern Engineering (Plastics) Ltd. (647,102).—January 15. Capital: £100 in £1 shares. To carry on the business of manufacturers of and dealers in plastic materials, etc. The directors are: Denis H. Purser, 38 South Road, Northfield, Birmingham 31 and Ernest J. Price, 15 Harvard Road, Solihull. Regd. office: Savoy Works, Pershore Road, Birmingham 30.

Lime Bank Products Ltd. (647,435).—January 20. Capital: £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in goods and products made of natural and synthetic rubber, etc. The directors are: George Bywater, 30 Norman Grove, Longsight, Manchester 12; Ernest Teasdale, 73 Warde Street, Manchester 15; Joan P. Cassell, Broad Terrace, Legh Road, Knutsford, Ches. Regd. office: 15 Lime Bank Street, Ardwick, Manchester.

PATENT LIST

Printed copies of the Specifications in the following list, published by permission of the Controller of H.M. Stationery Office, can be obtained from the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d., including postage, but about six weeks after the date of this publication will usually elapse before they come available. Orders with remittance may be sent in advance to the Patent Office, and will be fulfilled immediately the Specifications are published.

COMPLETE SPECIFICATIONS ACCEPTED

Open to public inspection on February 3 1960

Firestone Tire and Rubber Co. Apparatus and method of manufacturing rubber articles. 827,263.

A. Sestini. Apparatus for the surface treatment of plastic material films to make the printing indelible. 827,429.

Farbenfabriken Bayer A.G. Process for the production of polyurethane foam plastics.—827,473.

General Motors Corporation. Cutting of flexible thermoplastic sheet material and the making of inlays of such material. 827,349.

Vereinigte Glanzstoff-Fabriken A.G. Process for lowering the shrinkage power of polyolefine filaments. 827,500.

Goodyear Tire and Rubber Co. Vehicle for transporting and storing liquids. 827,444.

Badische Anilin- and Soda-Fabrik A.G. Continuous production of phthalodinitriles. 827,355.

Badische Anilin- and Soda-Fabrik A.G. Production of aromatic aminosulphonylamidines. 827,446.

Shell Research Ltd. Process for the production of epoxy ethers. 827,450.

Eastman Kodak Co. Fibres, filaments or yarns made from a mixture of cellulose acetate and a polymer. 827,455.

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Vinyl Products Ltd. Manufacturer of vinyl esters. 827,718.

Tootal Broadhurst Lee Co. Ltd. Formation of aldehyde resins. 827,645.

Dunlop Rubber Co. Ltd. Pneumatic tyres. 827,849.

Tootal Broadhurst Lee Co. Ltd. Process or the treatment of native cellulosic textile materials with a synthetic resin. 827,647.

Farbwerke Hoechst Aktiengesellschaft Vorm. Meister, Lucius and Brüning. Process for the printing of textile fibre material made of aromatic polyester fibres or cellulose triacetate fibres. 827,731.

Dunlop Rubber Co. Ltd. Method for bonding together bodies of polyurethane foam. 827,605.

Olin Mathieson Chemical Corporation. Extrusion apparatus. 827,973.

Firestone Tire and Rubber Co.—Speed synchronizing means for independent multidriven rolls. 827,982.

Dow Chemical Co. Stabilization of polyolefins. 827,661.

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ADHESIVE chemist required for research and development. Previous experience essential, including knowledge of synthetic rubber and latices. Rapidly expanding firm, good prospects.—Apply in writing to Managing Director, Crispin Chemical Co. Ltd., Coleman Road, Leicester. (77)

A RESEARCH chemist and a production chemist are required for the development and manufacture of polyurethane foams. Some previous knowledge and experience in this field would be preferred but all applications for these two positions will be considered. An attractive salary is offered with a rapidly expanding company. Replies in confidence to:—Aeropreen Products Limited, Lindsay Avenue, High Wycombe, Bucks. (82)

ASSISTANT rubber technologist, L.I.R.I., production experience of footwear compounds. Excellent prospects.—Sam Kay Rubber Co. Ltd., Hope Mill, Portwood Place, Stockport, Cheshire. (31)

ASSISTANT to manager of rubber moulding department required by Hall and Hall Ltd., to liaise between day and night shifts. Hours 1.30 p.m. to 10 p.m. Monday to Friday inclusive. Company house available if required.—Full details of experience to the Secretary, Hall and Hall Ltd., Oldfield Works, Hampton, Middlesex. (79)

ASSISTANT works manager for small cable works, practical experience of all rubber and plastic operations including mixing imperative, and preferably experience of planning and incentive schemes. Write stating age, experience and salary required.—Box 74. (74)

A YOUNG man about 23 years of age is required to fill the vacancy of assistant to technical manager of an expanding rubber company near London. It is intended that the successful applicant will eventually succeed the technical manager. The vacancy will interest men studying for G.I.M.E. The post requires a man capable of carrying out liaison work with customers and of carrying to fruition investigations relating to production problems. Commencing salary £600 per annum, with participation in staff bonus scheme.—Reply in confidence to Box 66. (66)

GENERAL foreman required for small rubber factory situated London/Essex border. Thorough knowledge open mill mixing, moulded mechanicals, extrusions, etc. Excellent opportunities for right man. Pension scheme.—Box 71. (71)

INSPECTION. Rubber manufacturers in South-West London require 2 shift inspectors for press shop (moulded mechanicals). Basic salary £14 per week, plus overtime and night allowances.—Apply giving details of experience to Box 67. (67)

MOULDING controller required by substantial company, to install new system, and take charge of production. Work is is of a non-domestic specialised nature, with exceptional scope for expansion. A very fair salary will be paid, in balance with experience. Apply, confidentially, to Managing Director.—Box 56. (56)

A RUBBER chemist or applicant suitable to train required by rubber manufacturers situated near Manchester. Candidates should be between 20 and 30, must have H.N.C. and A.I.R.I. qualifications. Every opportunity for advancement both in remuneration and status. Contributory pension scheme. Write giving age, qualifications and particulars of previous appointments with dates to Managing Director.—Box 69. (69)

APPOINTMENTS VACANT

(continued)

EXPERIENCED rubber mould designer required for medium sized factory producing industrial mechanicals. Applicant must be fully conversant with all stages of manufacture, and able to take complete responsibility for an established mould design department. Assistance with housing if required. Apply Works Manager, Heston Rubber Products Ltd., Tir-y-Berth, Hengoed, Glam. (61)

Technical assistant required by editor of Rubber Journal and International Plastics. Degree in Chemistry or equivalent qualification in rubber/plastics necessary. Good prospects.

Details of experience to Managing Director, MacLaren and Sons Ltd., 131 Great Suffolk Street, London, S.E.1 (63)

MIDLANDS company manufacturing general rubber mechanicals has a number of staff vacancies for supervisors in the following departments—moulding, handwork, mixing and calendering (including internal mixers), extrusion, stores and transport. Applications are invited from young men in the 25-30 age group with knowledge of the respective types of work who will show keenness, loyalty and a genuine desire to progress. Commencing salary will be £700 p.a., and assistance with housing will be available if required.—Apply Box 54. (54)

RUBBER technologist LIRI or equivalent standard required by Hall and Hall Ltd., Hampton, Middlesex. Specialised development work on synthetic rubber products. Apply in writing, giving details of experience, to the Chief Chemist. (55)

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A POST IN TECHNICAL SALES. The primary responsibility of the position is dealing with technical sales correspondence relating to synthetic rubbers. The successful applicant, who will be in his 20's, will eventually be transferred to the rubber laboratory near London, or to the technical sales force. Some experience in rubber technology desirable but not essential. (Ref. TECH.)

Employees participate in a generous contributory pension scheme. Good starting salaries. Applications should be made to:—The Elastomer Sales Manager, Du Pont Company (United Kingdom) Ltd., 76 Jermyn Street, London, S.W.1., quoting appropriate reference. (76)

APPOINTMENTS VACANT

(continued)

RUBBER company in Manchester area require assistant development chemist, age under 30, for work on belting of all types. Some previous experience would be desirable but not essential. Minimum qualification L.I.R.I. or equivalent. Studies and National Service should be completed.—Apply giving full details of age, education and experience, to Box 65. (65)

SENIOR foreman required for rubber mixing, calendering and extruding departments of cable works, London area. Write stating age, experience and salary required.—Box 75. (75)

WORKS chemist required for production of Polyurethane foam in an organization situated in the Manchester area. Applicants must have practical experience in this field and should preferably possess a qualification. Initiative and organizing ability is essential and the post carries a four figure salary.—Apply in confidence to Box 64. (64)

YOUNG man required for liaison duties with customers involving routine visits of a technical sales nature to rubber and allied trade companies, also special problem investigations. The successful applicant will be responsible to the Technical Sales Manager and Chief Chemist and must be a man of good theoretical and practical rubber knowledge with the ability to deal with cus omers. Salary will depend on age, qualifications, etc.—Apply Box 78. (78)

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GRADUATE chemist, A.I.R.I., A.N.C.R.T., 29, seeks progressive senior position. Eminently suitable as chief chemist of small or medium-size firm where ability and initiative are duly rewarded.—Box 70. (70)

SENIOR field executive seeks responsible position with reputable rubber manufacturers. Wide experience all branches (tyres excepted) in London, Midlands, Southern England and South Wales. Highest credentials.—Reply in strictest confidence to Box 48. (48)

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REQUIRED. Calendering capacity for frictioning heavy ducks up to 62in. width x 200 yard rolls. Please state capacity available.—Box 36. (36)

REQUIRED 16in. 3 or 4-bowl calender.—Details and prices to Box 83. (83)

WANTED urgently. Water hydraulic press loading table. Table size 36in. x 24in. Stroke 20in. Height 33in. (Type Dixon No. 818).—Box 68. (68)

PATENTS

6d. a word, Minimum £1. **Box 2/-.**

THE Proprietors of British Patent No. 721,697 for 'Improvement in the Structure of Tyres for Road Wheels of Vehicles,' desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder.—Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2. (72)

MISCELLANEOUS

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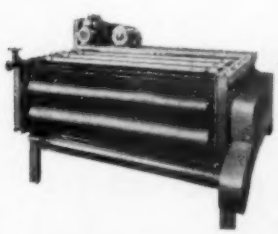

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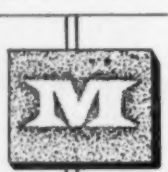
INDEX to ADVERTISERS

Page numbers below indicate the last occasion on which an advertisement appeared in this volume. Where the advertisement appeared on the covers or in the supplement, the figure in parentheses is the number of this issue

	Page
Allcock, J., & Sons Ltd.	ix
Amalgamated Oxides (1939) Ltd.	vi (4)
Anchor Chemical Co. Ltd.	Cover i
Anderson, Joseph, & Sons Ltd.	v
Armour Hess Chemicals Ltd.	—
Associated-Rediffusion Ltd.	247
Astor Boisselier & Lawrence Ltd.	209
Baker Perkins Ltd.	Cover iv (4)
Barfoot, T. W.	x
Belgrave Industries (Exports) Ltd.	x
Birch, Singleton, W., & Sons Ltd.	225
Boston Marine & General Eng. Co. Ltd.	134
Bridge, David, & Co. Ltd.	228
Bright, John, & Bros. Ltd.	iv
British Electrical Development Association	—
British Geon Ltd.	vii
British Nylon Spinners Ltd.	Cover iii
British Recovered Rubber Co. Ltd.	i (6)
British Resin Products Ltd.	ix (3)
British Titan Products Co. Ltd.	x (2)
Cabot Carbon Ltd.	201
Carlton Press Knives Ltd.	—
Carter Bros. (Rochdale) Ltd.	v (6)
Cleggswood Oil Distillery Ltd.	vi (6)
Cohen, George, Sons & Co. Ltd.	183
Collison Engineering Co. Ltd.	224
Columbian International (Gt. Britain) Ltd.	iii (6)
Consolidated Zinc Corporation (Sales) Ltd.	—
Crosfield, Joseph, & Sons, Ltd.	213
Croxton & Garry Ltd.	226
Cruickshank, R., Ltd.	iv (6)
Davis Plastics Ltd.	—
Dietzel, Hugo	vi (4)
Dixon, T. H., & Co. Ltd.	i
Dunlop Rubber Co. Ltd.	199
Dunn Bros. Manchester Ltd.	—
Du Pont Co. (United Kingdom) Ltd.	v (2)
Durham Raw Materials Ltd.	viii (2)
Economist Intelligence Unit Ltd., The	—
English Clays Lovering Pochin & Co. Ltd.	261
Esso Petroleum Co. Ltd.	—
Factice Research & Development Assoc.	239
Fawcett Preston & Co. Ltd.	iii (4)
Fellner & Ziegler GmbH.	—
Ferguson, A. O., & Co. Ltd.	x
Ferguson, James, & Sons Ltd.	vi (5)
Ferguson Shiers Ltd.	—
Foamair Ltd.	iii
Forrest, H., & Sons (E.P.M.) Ltd.	185
Gardner, Henry, & Co. Ltd.	109
General Utilities (Stockport) Ltd.	—
Goodyear Tyre & Rubber Co. Ltd.	157
Grantham Rubber Machinery Co. Ltd.	236
Greeff, R. W., & Co. Ltd.	iv
Gresham & Craven Ltd.	vi (2)
Gummi und Asbest	vi (4)
Haigh, John, & Co. Ltd.	—
Halsteads Engineers (Leyland) Ltd.	iv (5)
Hankin, Geo., & Co. Ltd.	vi (6)
Hardman & Holden Ltd.	—
Hatcham Rubber Co. Ltd.	xi
Hay & Robertson Ltd.	209
Hercules Powder Co. Ltd.	iii (1)
Hilton, Wallace & Co. Ltd.	224
Hubron Rubber Chemicals Ltd.	Cover iv
Hughes & Hughes Ltd.	261
Hunt Heat Exchangers Ltd.	I
Iddon Bros. Ltd.	ii
Imperial Chemical Industries Ltd. (Billingham)	121
Imperial Chemical Industries Ltd. (Dyestuffs)	191
Imperial Chemical Industries Ltd. (Heavy Organic Chemicals)	—
Imperial Chemical Industries Ltd. (Plastics—Butakon)	Cover ii (6)
Imperial Chemical Industries Ltd. (Silicone)	—
Institution of the Rubber Industry	185
International Corporation Ltd.	—
International Synthetic Rubber Co. Ltd.	xii
Ioco Ltd.	149
Kautschuk und Gummi	184
Kendell, T., & Sons Ltd.	58
Latex Engineering Co.	217
Lavino (London) Ltd.	—
Leeds & Bradford Boiler Co. Ltd., The	II
Leyland & Birmingham Rubber Co. Ltd.	—
Lonabarc Ltd.	vii (6)
Lord, R., & Sons Ltd.	224
Marsman, G. J.	261
McKechnie Bros. Ltd.	205
Maclaine, Watson & Co. Ltd.	iv (1)
Micafine Ltd.	iv (6)
Monsanto Chemicals Ltd.	—
Muehlstein, H., & Co. (London) Ltd.	262
Muller, Max	101
Northwestern Rubber Co. Ltd.	iv
Novadel Ltd.	—
Oldham, Thomas, Ltd.	vi (6)
Oswald & Duncan Ltd.	viii
Philblack Ltd.	188
Phoenix Rubber Co. Ltd.	152
Planters Engineering Co. Ltd., The	vi (6)
Polymer (United Kingdom) Ltd.	233
Preston Tyre Fabric Manufacturing Co. Ltd.	viii
Price's (Bromborough) Ltd.	—
Pullen, James H., (1942) Ltd.	vii (6)
Reed Bros. (Eng.) Ltd.	251
Rhein-Chemie GmbH.	vii (6)
Robinson Bros. Ltd.	viii (4)
Robinson, Joseph, & Co. Ltd.	139
Rotunda Ltd.	—
Rubber Age (New York) Ltd.	—
Rubber Latex Ltd.	205
Rubber Regenerating Co. Ltd., The	Cover ii
Shaw, Francis, & Co. Ltd.	241
Shell International Chemical Co. Ltd.	243
Shell Mex & B.P. Ltd.	—
Smith, Alfred, Ltd.	iv (2)
Smith, Wilfrid, Ltd.	xi
Sondes Place Research Laboratories Ltd.	iv (4)
Squire, Frederick, Ltd.	187
Stechler, L., & Co. Ltd.	224
Steel, J. M., & Co. Ltd.	ii (2)
Steele & Cowlishaw Ltd.	—
Stott, James, Ltd.	v (4)
Sturge, John & E., Ltd.	—
Sutcliffe Speakman & Co. Ltd.	123
Swinnerton, S. & J. H., Ltd.	261
Tanner Bros. (Greenfield) Ltd.	—
Turner Machinery Ltd.	—
Union Carbide Ltd.	—
United Norit Sales Corporation Ltd.	—
Universal Oil Co. Ltd.	165
Universal Oil Products Co.	—
Vulcan Equipment Co. Ltd.	89
Wallace, H. W., & Co. Ltd.	ix
Wallis Engineering Co.	—
Washington Chemical Co. Ltd., The	—
Welwyn Tool Co. Ltd.	109
Wiggins, Teape Group, The	45
Witco Chemical Co. Ltd.	251
Zama Ltd.	iii



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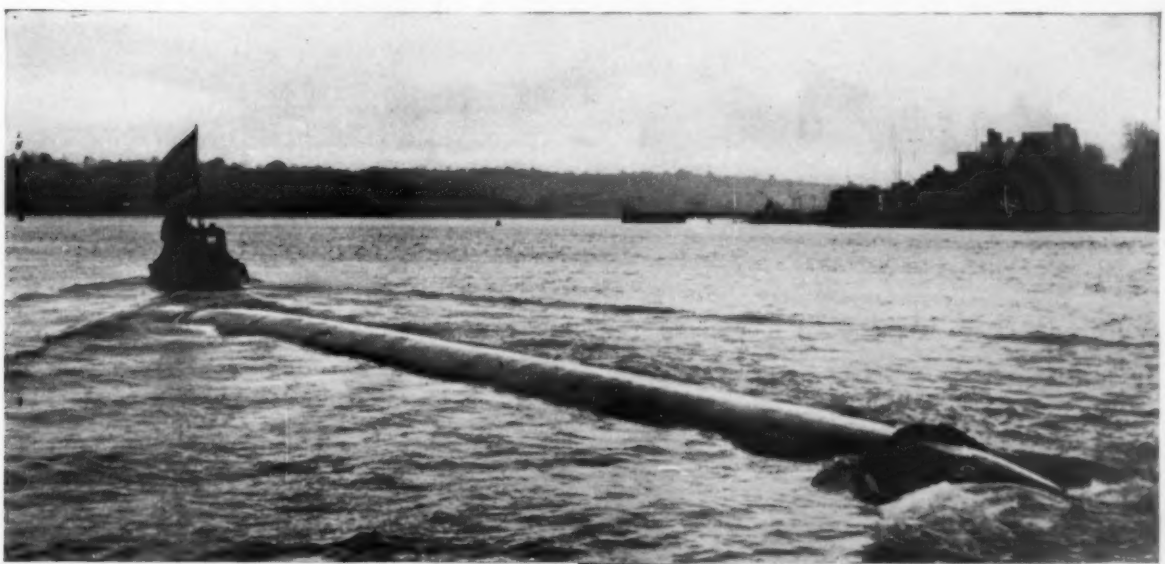

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